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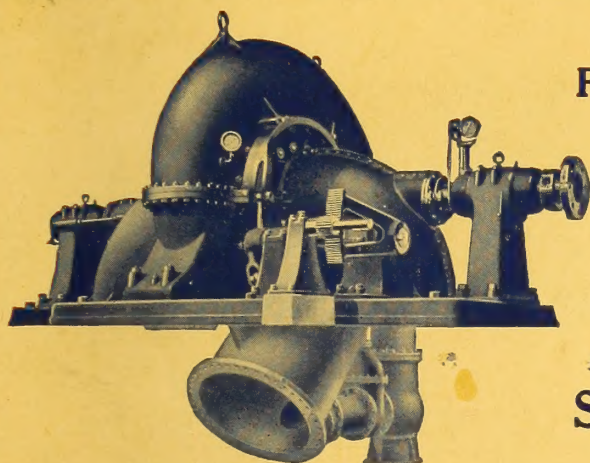






# Electrical News

Generation, Transmission and Application of Electricity



5250 Horse Power 275 Feet Head

## 90% EFFICIENCY From SMITH HYDRAULIC TURBINES

Recent tests at Holyoke, Mass. of Smith Turbines have again proven their superiority over any turbine now manufactured.

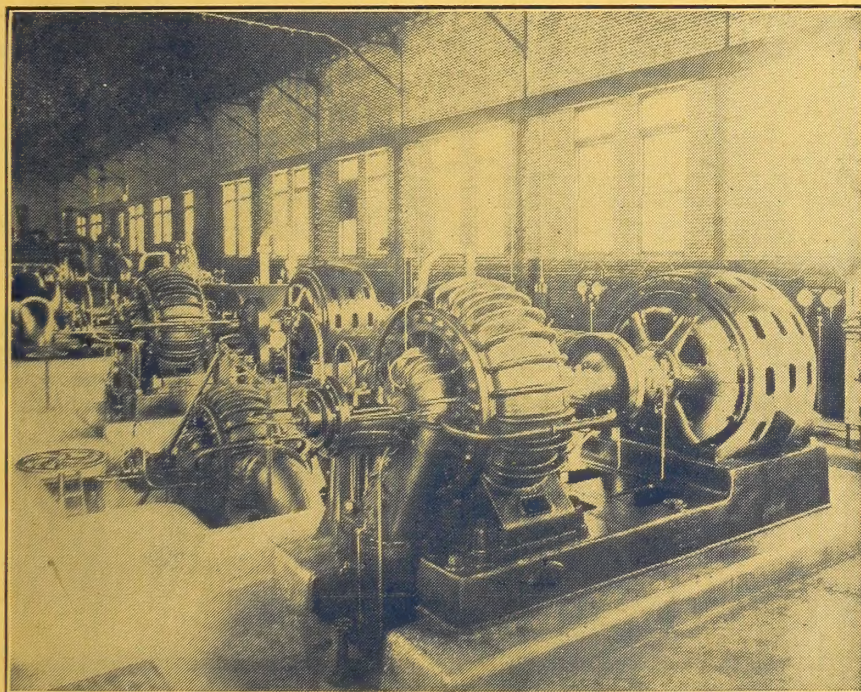
These tests showing efficiencies from 89% to over 90%.

We design and build turbines for heads from 5 feet to 650 feet.

*Send for Bulletin N*

**S. Morgan Smith Co., York, Pa.**

Branch Offices: 176 Federal St., BOSTON, MASS.  
614 American Trust Bldg., CHICAGO



Three 10,000,000 Gallon Pumps against 200 lbs. pressure supplied to the Montreal Power & Water Co.

## High Efficiency Water- works Pumps

One of the pumps shown in the picture was installed by us two years ago and we have since installed the other two shown in the same picture.

*Repeat Orders  
Speak For  
Themselves*

**BOVING & CO. OF CANADA, LIMITED**  
TORONTO VANCOUVER Works LINDSAY, ONT.



# UNDERGROUND CABLES

LOW AND HIGH TENSION

FOR LIGHTING,  
POWER,  
STREET-  
RAILWAYS,  
TELEPHONE,  
TELEGRAPH.



ARMOURED  
CABLES FOR  
STREET  
LIGHTING,  
PAPER  
INSULATED  
CABLES OF ALL  
DESCRIPTIONS,  
RUBBER INSULA-  
TED CABLES &c.

Also Bare and Weatherproof Wires and Cables,  
Magnet Wire, Flexible Cords, &c.

Galvanized Iron Wire and Strand

HEAD OFFICE :

**MONTREAL, CANADA**

BRANCHES :

**Toronto,**

**Winnipeg,**

**Halifax,**

**Vancouver.**



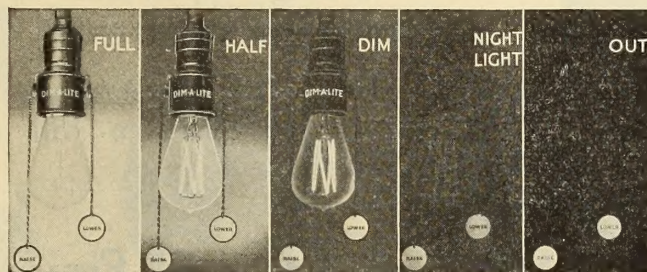
# TURN DOWN ELECTRIC LIGHTS

with a

## DIM-A-LITE

Makes any Lamp a "Turn Down Lamp"

*It  
Saves  
the  
Current*



*Lasts  
a  
Life  
Time*

### Five Degrees of Light

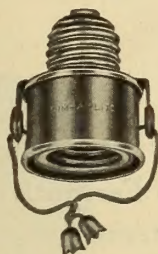


Fig. 23  
Pull-Chain  
Type

A portable attachment for a single electric light. Not a lamp—merely a "vest pocket" rheostat.

Can be attached in a few seconds.

Suitable for any lamp and any current—direct or alternating.

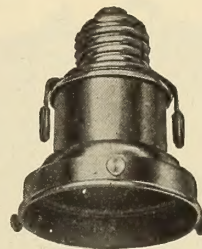


Fig. 24  
Shade Holder  
Type

**FIRE-PROOF**

**FOOL-PROOF**

**UNBREAKABLE**

Approved by Fire Underwriters

*Write for Special Dealers Proposition*

Carried in Stock by your Jobber.

# Benjamin Electric Mfg. Co.

of Canada, Limited

11-17 Charlotte Street

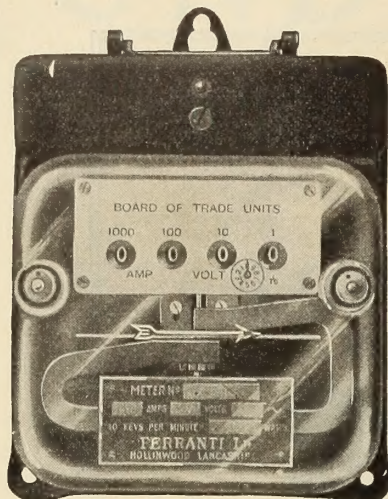
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TORONTO



# CONSIDER THE WIREMAN

and how he treats your meters.

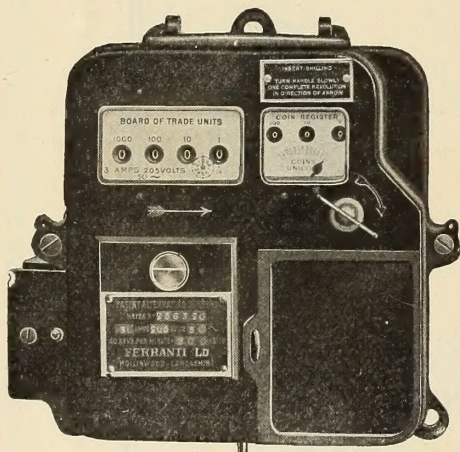


Single Phase House Service Meter,  
Glass Cover.

The man who installs your meters is very human. He will handle roughly a meter of rough appearance but he will handle carefully a well finished instrument.

The nicely finished case and accurately made mechanism will suggest careful handling.

## Ferranti Meters are of Handsome and Finished Appearance



Single Phase Prepayment Meter.

But the less thoughtful wireman must be taken into account. All **Ferranti** meters are made, case and contents, so strong and rugged as to withstand any reasonable amount of rough handling and they will maintain their accuracy in spite of it.

Ferranti Meters Throughout are of Strong Mechanical Construction

**FERRANTI ELECTRICAL COMPANY OF CANADA  
LIMITED**

90 Sherbourne St.  
TORONTO

704 Unity Bldg.  
MONTREAL

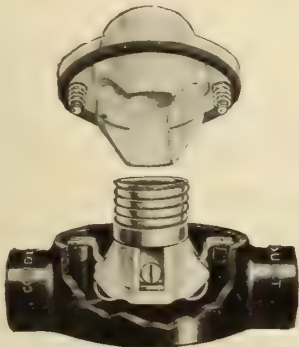
Farmer's Advocate Bldg.  
WINNIPEG



# Elliptical Condulets, Fittings and Covers

## Easy to Install, Strong in All Respects, Weather-Proof with Gasket

Made in  $\frac{1}{8}$ ,  $\frac{3}{8}$  and 1-inch Sizes



Type RJ with Receptacle  
(Cut away and Exploded View)



Type RJX with Blank Metal  
Cover



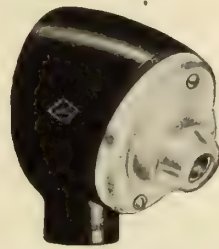
Type RJU with Hubbell Plug  
Receptacle



Type RJL with Two-Wire  
Porcelain Cover



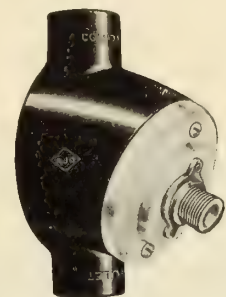
Type RJF Condulet Body



Type RKD with  $\frac{1}{8}$  in.  
Female Nipple Fixture  
Rosette



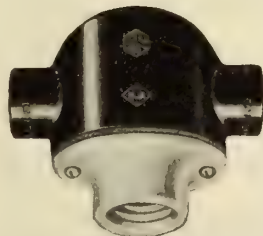
\*Type RKC with Male  
Nipple Metal Cover



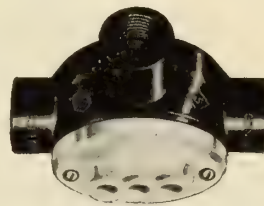
\*Type RJD with Male  
Nipple Porcelain Cover



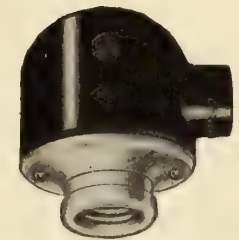
Type RKA with  $\frac{1}{8}$  in.  
Male Nipple Fixture  
Rosette



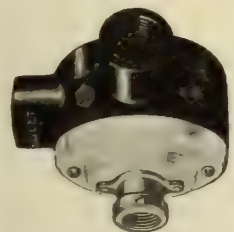
Type RJA with Receptacle



Type RJT with Three-Wire  
Porcelain Cover



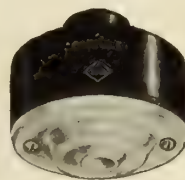
Type RKB with Recep-  
tacle with Shade-Holder  
Groove



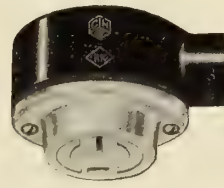
\*Type RJR with Female  
Nipple Porcelain Cover



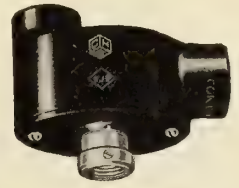
Type RJK with Blank  
Metal Cover



Type RKK with Cord  
Rosette



Type RK with Hubbell  
Polarity Plug Receptacle



\*Type RJB with Female  
Nipple Metal Cover

\*Nipples covers are made with 4 sizes of nipples— $\frac{1}{8}$ ,  $\frac{1}{4}$ ,  $\frac{3}{8}$  and  $\frac{1}{2}$ -inch.

## Crouse-Hinds Company of Canada, Ltd

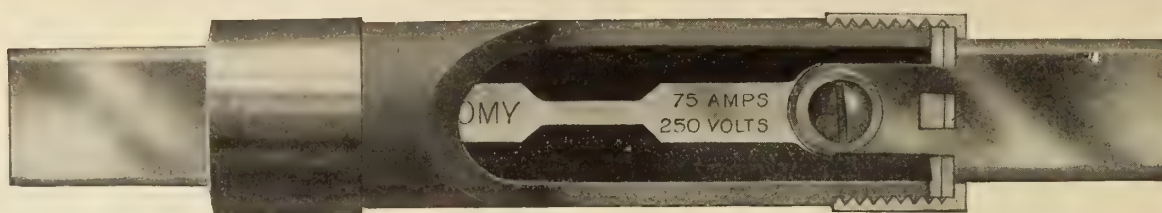


Main Office and Works :

Toronto, Ontario, Canada

Kindly send me free copy of Condulet Catalogue No. 1000  
Name ..... City ..... Prov. .... 2614





**"Look for the Gray Shell"**

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense over 80 per cent** by using

## ECONOMY RENEWABLE FUSES

**They use Economy Renewable Fuses for these reasons:**

- First**, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
- Second**, because it is the only renewable fuse that is uniformly rated.
- Third**, because it is the only design so far produced that provides the desired electrical characteristics.
- Fourth**, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
- Fifth**, because they never vent fire or hold a sustained arc and are absolutely safe.
- Sixth**, because they meet the performance specifications governing the use of such devices.

### **Special Announcement !**

Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now **YOU** figure what fuse is the cheapest not only to buy but also to maintain.

*Write for Bulletin, Prices and Discounts*

## Economy Fuse & Mfg. Co. of Canada, Limited.

Herald Building, Montreal

**ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.**

## XCELADUCT GALVANIZED and ORPENITE ENAMELLED CONDUITS

These two brands of Interior Conduits represent the acme of Canadian made products.



**XCELADUCT** — this exceptionally high-grade galvanized conduit is made of easy-bending spellarized steel tubing. Copper subcoat and a zinc coating doubly protects it against rust, corrosion and atmospheric conditions.

**ORPENITE CONDUIT**—A specially prepared coating of enamel makes this conduit proof against rust and all weather conditions. It is made of easy-bending spellarized steel tubing.

In both brands of conduits the interior presents a smooth enamelled surface, which makes fishing rapid and easy—clean threads.

**If your jobber does not carry a stock—write us.**

### THE ORPEN CONDUIT COMPANY, LTD.

TORONTO

MONTREAL

**The Sign  
of  
QUALITY  
FIRST**

**ALWAYS SPECIFY "XCELADUCT" OR "ORPENITE."**



# SWEDISH GENERAL ELECTRIC, LIMITED

(Successors to Kilmer, Pullen & Burnham, Limited)

Trade

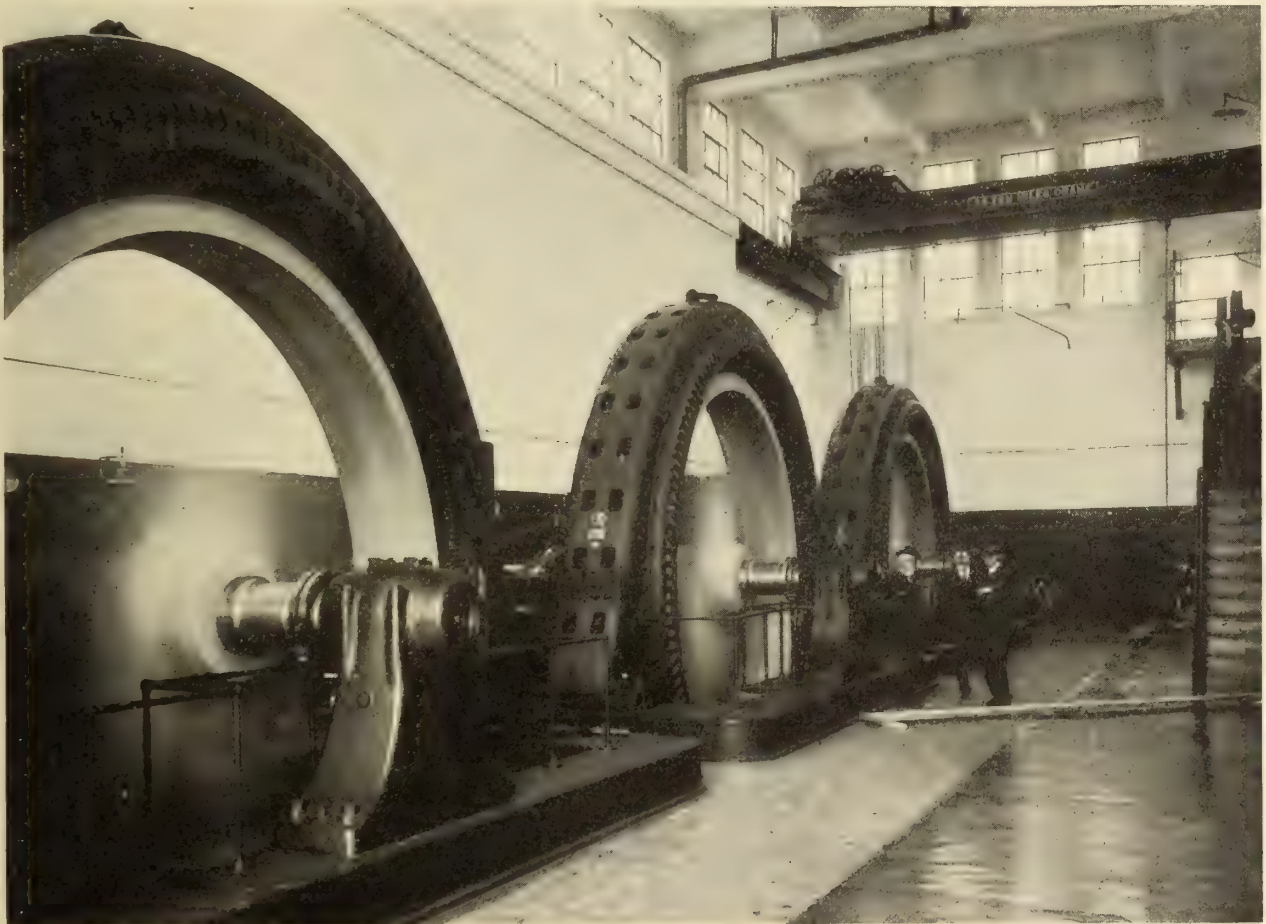


Mark

We Have Now Installed in Canada

## Over 150,000 H. P.

In Generators and Motors in Sizes from 1 to 6,000 H. P.



3—3750 KVA 2300 Volt, 3 Phase 60 Cycle, 164 RPM, Water Wheel Type, AC Generators installed in

The E. B. Eddy Company's Plant, Hull, P. Q.

*We solicit your enquiries.*

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**"GALVADUCT"**

The most perfect interior construction conduit on the market.  
Recognized as the standard of high quality.

Always specify Galvaduct  
or Loricated conduits



The Bank of British North America, Montreal  
A "GALVADUCT" Building

**"LORICATED"**

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

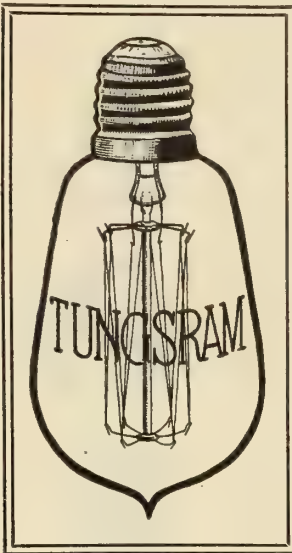
If your jobber cannot supply  
you—write us.

**Conduits Company  
Limited**

**Toronto - Montreal**

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**" TUNGSRAM "**

**THE**

strongest filament

**PERFECT**

satisfaction to consumers

**LAMPS**

for all Lighting purposes.

All Sizes and Voltages carried in stock at Montreal.  
*Also for import.*

*Ontario Selling Agent*

**WALTER H. WARRINGTON**

406 Tyrrell Building

Main 2466

*Representing*

**TORONTO**

The Perkins Electric Company Limited, Montreal, P.Q.

Brandt-Dent Company, Watertown, Wis.

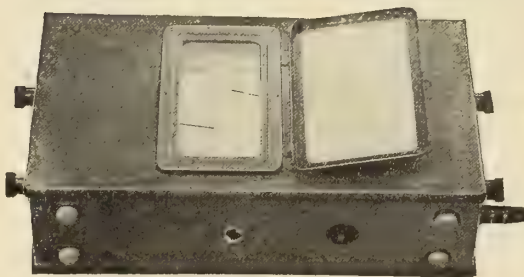
Crown Novelty Company, Chicago, Ill.

Flexible Conduit Company, Guelph, Ont.

## **Evershed & Vignoles, Limited**

Manufacturers of

**Electrical Instruments for all  
Conditions of Service**



D. C. Volt-Ammeter  
(Admiralty Type)

.001 Amps—1000 Amperes

.001 Volts—1040 Volts

The handiest D. C. Portable Volt  
Ammeter ever invented.

Sole Canadian Agent

**R. H. NICHOLS**

Dineen Building - TORONTO, Can.

## **Use the Railway's Trolley Poles**

as the basis of your new street  
lighting system. You can easily  
convert them into attractive  
Mazda Lamp Standards or  
arc lamp supports by use  
of



**ERECO**

**Combination**

**Railway**

**Lighting Pole**

**Fixtures**

This system, besides saving  
you the expense of under-  
ground construction, gets the  
wires up out of the way of  
traffic, where they are practi-  
cally unnoticeable and the curb  
line is not crowded with separ-  
ate lighting standards.

The progressive railway man-  
agement will gladly co-oper-  
ate with you with this object  
in view.

Design No. 10127

**Electric Railway Equipment Co.**  
Cincinnati, Ohio

Designers

Canadian Representatives:

Manufacturers

Dawson & Co., Limited, Montreal, Winnipeg

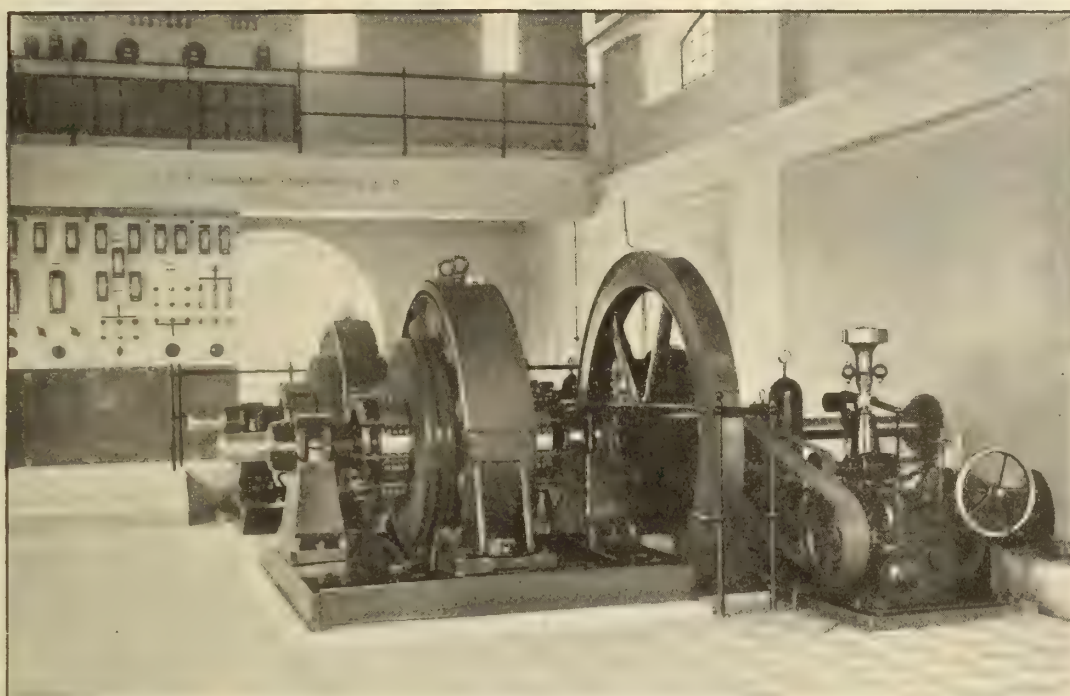
N. Y. Office, 30 Church St., Hudson Terminal Bldg.



# Swedish Electrical Machinery

NOTED FOR

## Efficiency and Workmanship



Hydro Electric Plant consisting of two 290 kw., 214 rpm., 220/440 volt, three wire D.C. Generators.

*We solicit your specifications for  
Electrical Equipment*

# BURNHAM ENGINEERING COMPANY

LIMITED

Canadian Dealers for

**The Amalgamated Electric Company of Sweden**

**Head Office :**

**Traders Bank Building, Toronto**

British Columbia Representatives:

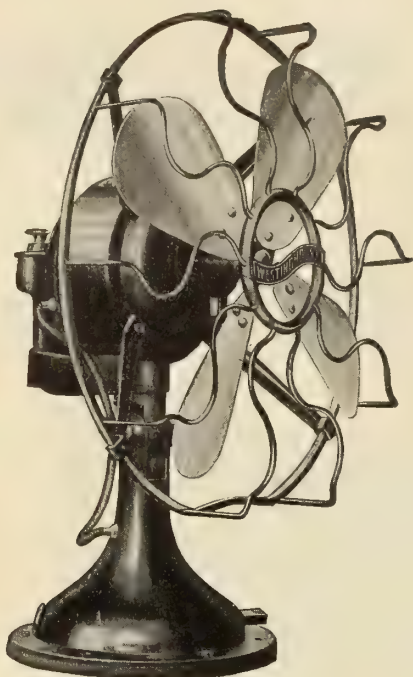
Macdonald, Marpole, Co., Limited  
VANCOUVER, B.C.



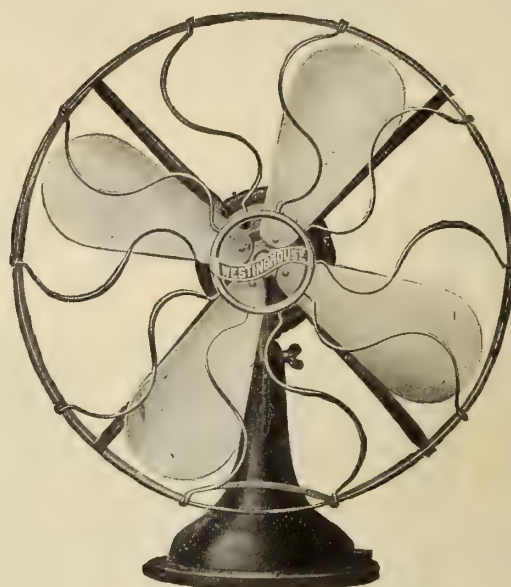
Montreal Representatives :

**Rudel Belnap Machinery Co., Ltd.**  
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Mechanical Oscillator



Desk and Bracket

Handle electric fans with entirely drawn-steel frames during the 1914 season.

## *Northern Electric* **Westinghouse** **Drawn-Steel Frame Fans**

The strength of Northern Electric Westinghouse drawn-steel frames is many times that of cast-steel frames.

The weight of these drawn-steel frame fans is much lighter than that of cast-iron frame fans.

This reduction in weight means a considerable saving in transportation charges and makes these drawn-steel frame fans much easier to handle, an advantage fully appreciated by the ultimate user. Ask about our profitable contract proposition. We assist contract holders with attractive literature, car cards, newspaper copy, cuts, etc. Write our nearest house for catalog.

*Northern Electric Company*  
LIMITED

MONTREAL

HALIFAX

TORONTO

WINNIPEG

REGINA

CALGARY

EDMONTON

VANCOUVER

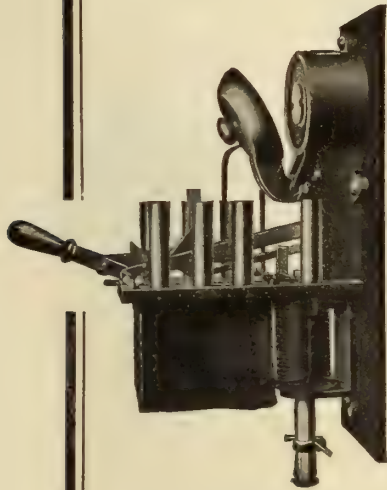
VICTORIA



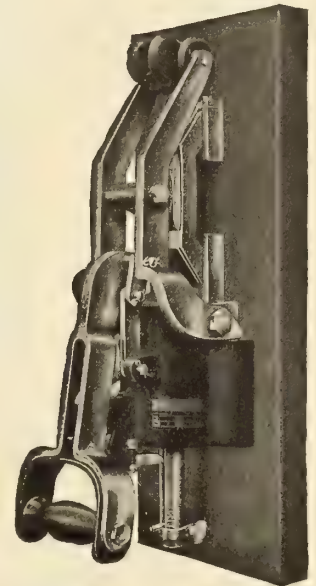
# Where Quality and Service Count

## "CONDIT"

### Protective Apparatus Runs Ace-High



TYPE "LS" 3 pole,  
600 volts, oil break-  
er, wall mounted  
with overload and  
no voltage release.



TYPE "K" 600 volt,  
1200 amp. single  
pole carbon break  
breaker with pull  
down handle.

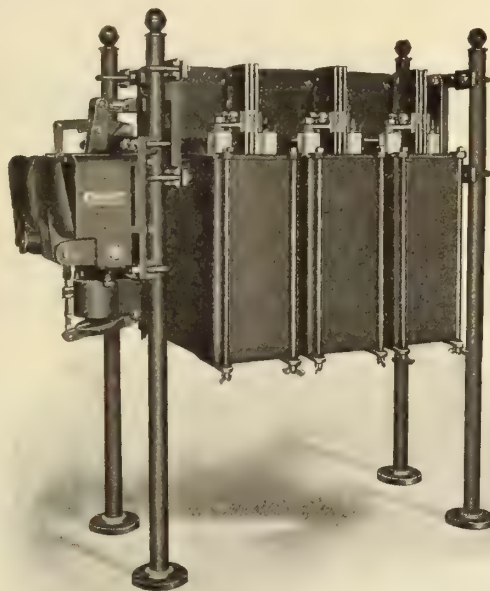
The Condit line of D.C. Carbon Break Circuit Breakers and A.C. Oil Switches is one of the most complete lines manufactured today.

**Rugged, Durable, Reliable are the Condit characteristics.**

Made in voltages up to 70,000 and with every attachment for automatic operation.

The largest Power Companies are using Condit A.C. and D.C. Protective Devices.

Our District House Specialist will tell you more.



Backed by the Con-  
dit name and the  
trademark of the  
Distributors.

TYPE "Y" 3 pole,  
2300 volts, 2000  
amps. automatic oil  
breaker.

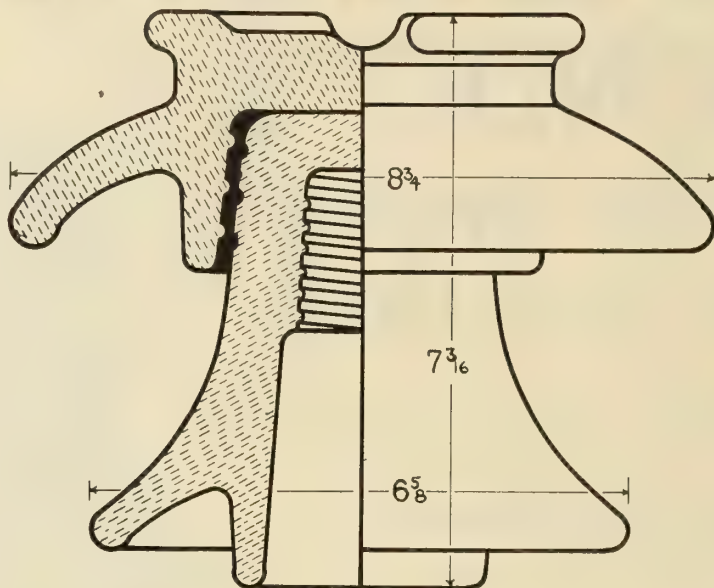
## *Northern Electric Company*

LIMITED

MONTREAL    HALIFAX    TORONTO    WINNIPEG    REGINA  
CALGARY    EDMONTON    VANCOUVER    VICTORIA



# CANADIAN INSULATORS



Number	133
Line voltage	30,000
Test voltage	100,000
Rain test	65,000
Leakage distance	17 <sup>3</sup> / <sub>4</sub> -in.
Pin hole	1 <sup>3</sup> / <sub>8</sub> -in.
Net weight	10 <sup>1</sup> / <sub>2</sub> -lbs.
Packed weight	12 -lbs.
No. per crate	6

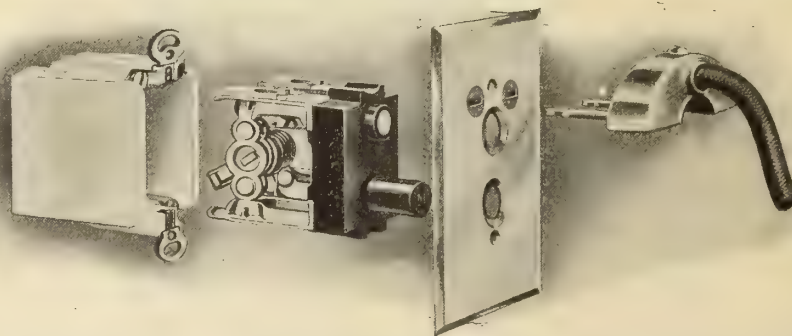
## The Canadian Porcelain Company, Limited

HAMILTON, - CANADA

TRADE **METROPOLITAN** MARK  
ELECTRIC MFG CO.

Panelboards, Switchboards, Knife Switches, Detachable Mechanism Flush Switches and Receptacles,

One Contact Box.  
One Face Plate  
with Renewable,  
Interchangeable  
Mechanism, and  
Receptacle Plugs



Metropolitan Detachable Mechanism Combined Switch and Receptacle.

*Send us your specifications, our price is right, and delivery the best.*

CANADIAN AGENTS:

## ECONOMY ELECTRIC CO.

Bank of Hamilton Building

Yonge and Gould Sts., TORONTO

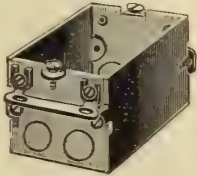


**"UNION" ENCLOSED FUSES**

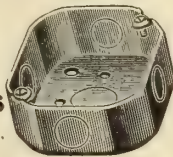
Approved and recommended by  
National Board of Fire Underwriters

Perfect in Operation

Will protect your system under all conditions  
ACCURATE, RELIABLE, INDICATING,

**"UNION"  
Sectional  
Switch Boxes**

Pat. April 2, 1901—March 1,  
1910—February 13, 1912

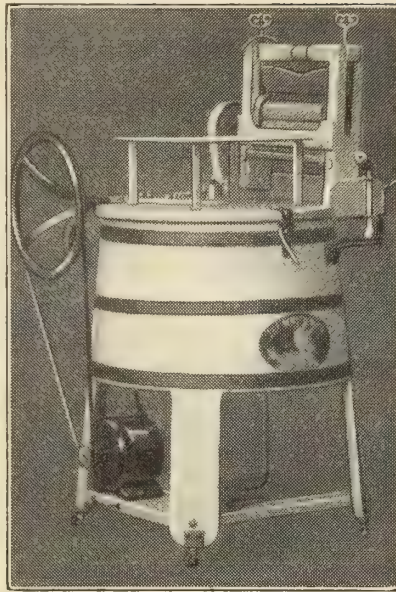
**CONDUIT BOXES AND COVERS**

Best constructed Switch Box made, equipped with reversible and sliding ears for old and new work, furnished in depths from 2 inches to 3½ inches deep.

Preferred by Contractors - - - Specified by Architects  
Carried in stock by all leading Jobbers

Write for complete catalog.

**CHICAGO FUSE MFG., CO.**  
CHICAGO and NEW YORK

**"White Dove"  
Electric  
Washer**

In every home having electricity the housewife is always acquiring new electric conveniences. When it comes to an electric washer have you something of real merit to offer? As a central station or supply house it is from you that the purchase will be made.

Sell "White Dove" Washers and you will have no kicks. Every "White Dove" Washer is tested and guaranteed.

*Write for our dealers proposition*

**White Dove Washer Co.**

Cobourg, Ontario

**Toronto & Hamilton  
Electric Company**  
HAMILTON**Offer for sale the following  
Second-Hand Motors**

- 2—50 H.P. Type C. Westinghouse, 2 phase, 60 cycle, 220 volts, 900 Rev. Starter, rails and pulley.
- 1—20 H.P. Type C. Westinghouse, 2 phase, 60 cycle, 220 volts, 900 Rev. Starter, rails and pulley.
- 1—20 H.P. Type CCL Westinghouse, 2 phase, 60 cycle, 220 volts, Starter, rails and pulley, 1200 Rev.
- 1—5 H.P. Type CCL Westinghouse, 2 phase, 60 cycle, 220 volts, 1800 Rev.
- 1—1 H.P. Type CCL Westinghouse, 2 phase, 60 cycle, 220 volts, 1800 Rev.
- 1—3 H.P. Type KQ C.G.E., 2 phase, 60 cycle, 220 volts, 1800 Rev.
- 2—2 H.P. Type 1G C.G.E., 2 phase, 60 cycle, 220 volts, 1800 Rev.
- 6—1 H.P. Type S T.H.E., 2 phase, 60 cycle, 220 volts, 1800 Rev.
- 4—2 H.P. Type S T.H.E., 2 phase, 60 cycle, 220 volts, 1800 Rev.
- 2—10 H.P. Type S T.H.E., 2 phase, 60 cycle, 220 volts, 1800 Rev.
- 3—½ H.P. Type S T.H.E., 1 phase, 60 cycle, 110 volt, 1200 Rev.
- 2—½ H.P. Type A T.H.E., 1 phase, 60 cycle, 110 volt, 1200 Rev.

For further particulars address

**Toronto & Hamilton Electric Co.**  
HAMILTON, ONT.

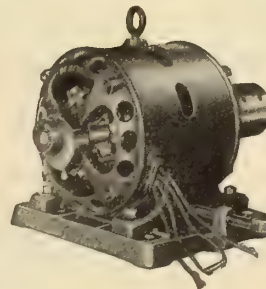
—AGENTS FOR—

**The Willard Storage Batteries.**

*If you specify*

*Century*

*on your order for a*

**Single Phase Motor**

you will secure a motor which is the result of more than 18 years of engineering concentration on the design and construction of single phase apparatus and which will give constant uninterrupted satisfaction under the most severe direct connected and geared service.

*Bulletin No. 201 fully describes them.*

**Century Electric Company**

19th, Olive to Pine Sts. ST. LOUIS, Mo.

CANADIAN AGENTS  
Jones & Moore Electric Co., Ltd.  
294 Adelaide St. W., Toronto  
Mainer Electric Co., Ltd.  
Winnipeg and Edmonton  
Rudel-Belnap Machy. Co., Ltd.  
Canadian Express Bldg., Mont.  
Rankin & Cherrill  
547 Main St., Vancouver



# Across Canada with the IMPERIAL WIRE & CABLE CO. LIMITED




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Sixth of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire & Cable Co.'s, Limited, wires.

---

---

*This picture shows the Parliament Buildings, Edmonton.*

This Building was wired with  
“Adanac” Rubber Insulated Wire

Architect	-	-	-	-	A. M. Jeffers, Edmonton
Engineer	-	-	-	-	James McAlear, Chicago
Electrical Contractors	-	-	-	-	Cunningham Electric Co., Calgary

“ADANAC” “IMPERIAL HIGRADE” and “30% PARA”

***Northern Electric Company***  
LIMITED

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver Victoria  
Successors to IMPERIAL WIRE & CABLE CO., LIMITED.

Correspondence previously addressed to Imperial Wire and Cable Co., Limited, at 611 C.P.R. Building., Toronto, and 902 Electric R. Chambers, Winnipeg, should now be addressed to the Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg.



## Representatives Wanted

Here is a splendid opportunity to handle these tried and tested instruments in your section. For 20 years we've specialized on this class of work and today "Connecticut" instruments are justly famous for their high quality and reasonable prices.

**CONNECTICUT**

### Electric Reset Annunciators and Interior Telephones

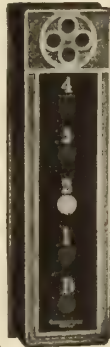
"Connecticut" Annunciators and "Connecticut" Interior Telephones appeal to the user because they are simple in construction, effective in action, look good, wear well and give lasting service.

Made in a wide variety of styles and sizes—each style suited to its particular requirement. You're selling satisfaction—making lasting customers—when you sell "Connecticut" goods.

Write for Catalog 22C and Full Details

Ask us for particulars of our proposition for representatives. Look over our Catalog and note the completeness, reasonable prices and high quality of the "Connecticut" Line.

**Connecticut Telephone & Electric Company, Inc.**  
Meriden, Conn., U. S. A.



## UNIFORMITY!

in mechanical strength, wearing quality, firmness of texture and lubricating quality, **every**

## "LE CARBONE"

(Made in France)

### Carbon Brush

in a million is absolutely identical.

This means that a type of **Le Carbone Brush** once installed to meet your conditions will always meet them on subsequent shipments.

*Le Carbone quality never varies!*

## Rougier Freres Inc.

63 Notre Dame, East  
MONTREAL, P.Q.



No. 579



No. 1043



No. 490



No. 1033

**E**XPERT workmanship on our cut shades and globes brings out the artistic and pleasing brilliancy that is intended.

Our new catalog No. 3 shows most of the standard cuttings.



No. 1030

WRITE FOR CATALOG

# JEFFERSON GLASS COMPANY LIMITED

Head Office & Works  
TORONTO

Branch Sales Offices

{ MONTREAL.  
WINNIPEG.  
VANCOUVER.





## "AMERICAN"

### Bituminized Fibre Conduit

has properties not possessed by any other type of conduit made which recommends it particularly for Underground Systems of Distribution.

*Interesting and Valuable Booklet "Underground Conduit Construction" free on request. Send for it.*

## American Conduit Co.

East Chicago, Ind., U. S. A. 140 Nassau St., N. Y. City

Distributors for Canada:

*Northern Electric Company*  
LIMITED

Montreal, Halifax, Toronto, Winnipeg, Regina,  
Calgary, Edmonton, Vancouver, Victoria

7 foot Lengths.  $\frac{3}{8}$  in. walls.  $\frac{3}{8}$  in. joints. Absorption, 100 Hrs.,  $\frac{1}{4}$  of 1%.  
Puncture Test 50,000 V. Electrolysis-proof—Water-proof—Gas-proof.



## PHANTOM LOADS

Portable and Laboratory  
Loads

The best that can  
be made.

Type B shown in  
cut.

*See for bulletin 19*

**THE STATES CO.,** 15 New Park Ave.,  
HARTFORD, CONN.

## MICA

Canadian Amber

Indian Ruby

### For Every Purpose

Cut or uncut, stamped to pattern. Selected to cut any size or in regular grades. Splittings, Washers, Gramophone Discs. I also carry the largest stock of Stove Mica in Canada.

*Write for prices and samples.*

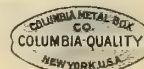
## S. O. FILLION

Miner, Importer and Wholesale Dealer

86-88 Duke St. - OTTAWA, Canada

BRANCHES—34 West 33rd St., New York Kodarma, Bengal, India

## Columbia Quality Steel Cabinets and Cutout Boxes



The above trade-mark now appears on products made by this Company. It is a sign in itself justifying confidence. A reputation for quality, service and everlastingly fair treatment has been acquired for it after but seven years of life. Wherever you see the COLUMBIA-QUALITY trade mark you can safely conclude that the product bearing it is all that is claimed for it—and a bit more.

## Columbia Metal Box Co.

226-228 EAST 144th STREET,

NEW YORK

## ILLUMINATION PROBLEMS

carefully executed

by

### A LIGHTING SPECIALIST

See us about House Wiring.

Main 3067.

### Electric Lighting Specialists Co.

Room 304A Tyrrell Bldg., 95 King St. E., Toronto

J. C. Salvaneschi, Manager.

## ASK US about

### Efficient

### Lighting

for your streets, factory, warehouse  
or yard

## A. H. WINTER JOYNER, Ltd.

76 Bay Street, Toronto

"Consult A Specialist"



**S**UCH discriminating care is used in the selection of raw materials from which CANADA wires and cables are made, and such extreme vigilance exercised during the course of manufacture that we are able to say that whenever you buy this well-known brand **you can't go wrong.**

Get our quotations on—

Transmission Cables Copper and Aluminum.

Weather Proof Copper and Aluminum Line Wire.

Rubber Covered Wires and Cables.

Railway and Power Feeder Cables in Copper and Aluminum.

Copper Trolley Wire.

Copper Clad Wire Bare and Weather-proof.

Telephone and Telegraph Wire Bare and Insulated.

Galvanized Steel Strand Guy Wire.

Prompt shipments made from stocks carried at Toronto, Montreal, Winnipeg and Vancouver.

**Canada Wire & Cable Co.**

Limited

**Toronto** 1170 Dundas Street **Ontario**

*Sales Offices :*

401 Lake of the Woods Bldg.  
Montreal, Que.

A. E. Esling, 150 Princess St.  
Winnipeg, Man.

Macdonald, Marpole Co., Ltd., 427 Seymour St., Vancouver, B. C.

**You  
can't go  
wrong**





*Packard*

# MAZDA LAMPS METERS TRANSFORMERS

*Ask the man who  
uses them*

**LARGE STOCKS CARRIED AT**

St. Catharines and Winnipeg;  
St. John Railway Co., St. John, N.B.;  
General Supplies, Limited, Calgary, Alta.;  
Rudel-Belnap Machinery Co., Canadian  
Express Bldg., Montreal, Que.

***The Packard Electric Co., Limited***

***Factory at St. Catharines, Ont.***

***General Sales Office,  
Traders Bank Bldg., TORONTO***

***N. W. Office and Warerooms,  
WINNIPEG***

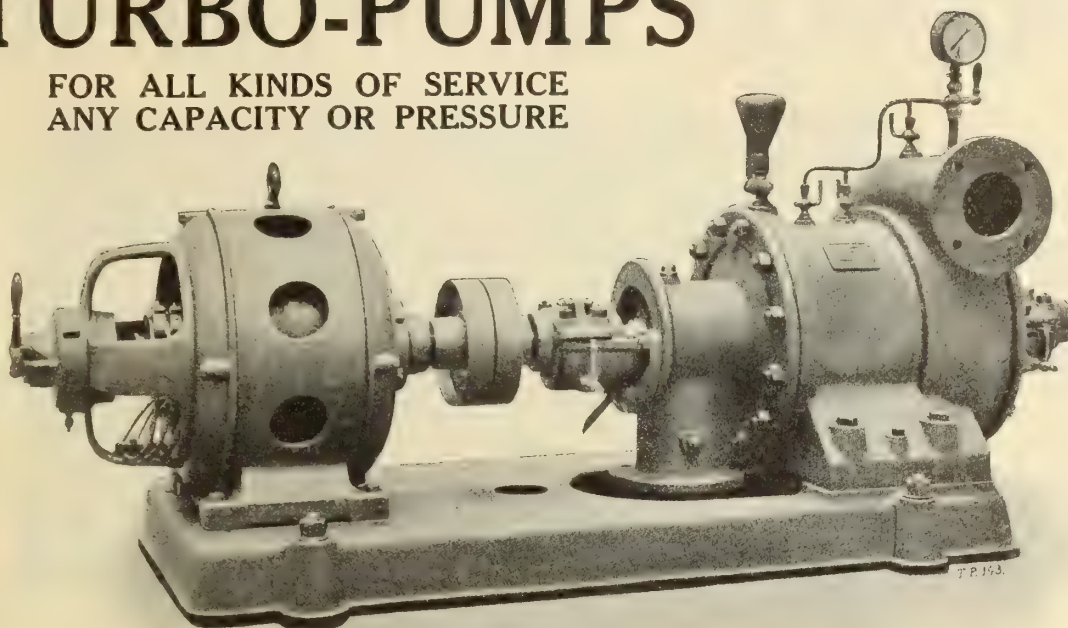


# TURBO-PUMPS

FOR ALL KINDS OF SERVICE  
ANY CAPACITY OR PRESSURE

Highest  
Efficiency

Greatest  
Reliability



**ESCHER WYSS & CO.** HEAD OFFICE FOR CANADA: 626-627 Coristine Bldg., Montreal, Que.

Agent for Western Canada: Mr. C. L. Trimmingham, 206 Nanton Building, Winnipeg, Man.

## Perfect Pressure Control

Can be obtained in tanks and reservoirs by starting and stopping the motor driven apparatus with

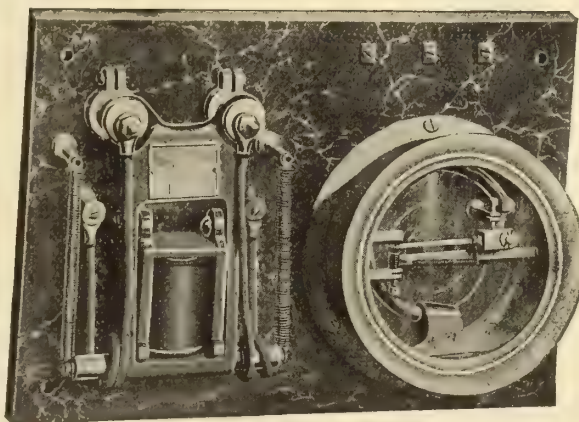
**THE SUNDH GAUGE**

**TYPE REGULATOR**

The simplest, strongest and most satisfactory regulator made. Operates on a pressure difference of 3 to 5 per cent. of maximum pressure. Wider range may be obtained by screwing down the left-hand screw.

The construction consists of a silver-tipped contact lever attached to the tube and moving between two silver contact points on pressure fluctuations.

The screw on the right is used for adjusting to maximum pressure desired, and the lower screw on left hand is for adjusting for difference in pressure.



Send for "Sundh" catalogue giving complete description of controlling devices for A.C. & D. C.

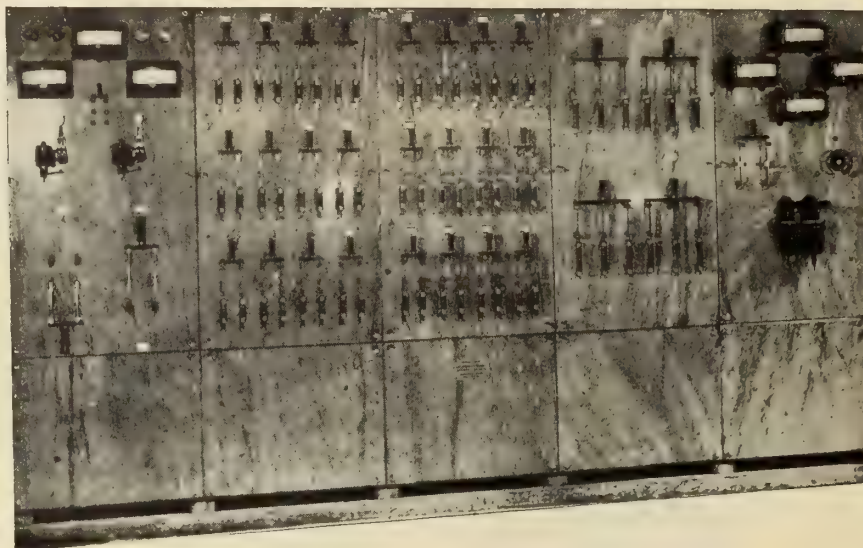
**Sundh Electric Company**

**New York, U.S.A.**



# "DEVOE" MEANS QUALITY

Panels,  
Switches,  
Switch-  
Boards  
built to  
any  
specifica-  
tion



An examina-  
tion of "DE-  
VOE" Stan-  
dard Panels,  
Switches and  
Switchboards  
will convince  
you they are  
the best made.

*We specialize in Switch Boards.*

## THE DEVOE ELECTRIC SWITCH COMPANY

Office and Factory 157 Craig Street West, Montreal, Que.

Frank G. Scofield, Ontario Sales Representative, Lumsden Building, Toronto, Ontario



## A New Line of

## High Tension Specialties



Designed and manufactured under the direction of practical and competent engineers of wide and varied experience

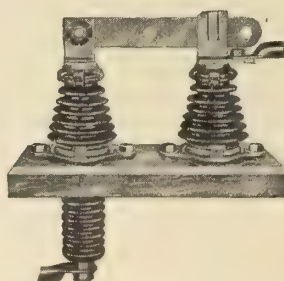
## GENERAL DEVICES & FITTINGS CO.

817-825 West Washington Blvd., Chicago, Ill.

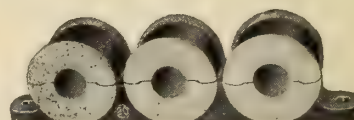
Bentz-Richardson Co., Limited,

114 Phoenix Block, Winnipeg, Manitoba

Disconnecting Switches, Busbar  
Supports, Clamp Insulating Sup-  
ports, Pins and Insulators



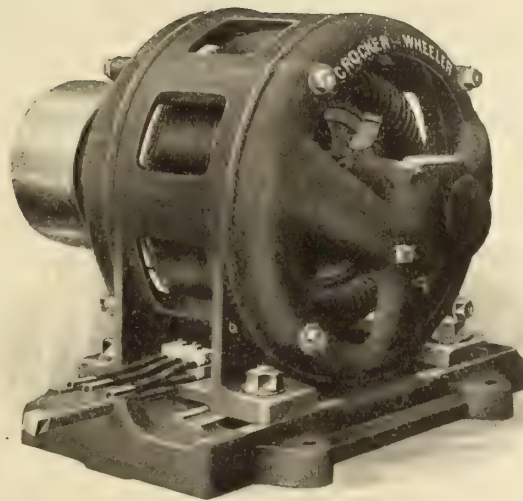
Switchboard and Pipe Fittings,  
Busbar Clamps, Copper Tube  
Fittings, Tee Connectors





The design of  
**Crocker-Wheeler**  
**Induction Motors**  
includes

Large Shafts  
Ideal End Ring  
Construction  
High Power Factor  
Large Journals



Lumen Bearings  
Strong Stator Frame  
Heavy Insulation  
Best Efficiency

Crocker-Wheeler Induction Motor. Sizes from  $\frac{1}{2}$  H. P. up

*They have many other desirable features—Bulletin 155 describes them.*

**THE CANADIAN**  
**CROCKER-WHEELER CO.**  
**LIMITED**

MANUFACTURERS AND ELECTRICAL ENGINEERS

*Head Office and Works*  
ST. CATHARINES

*District Offices*  
MONTREAL, TORONTO, VANCOUVER



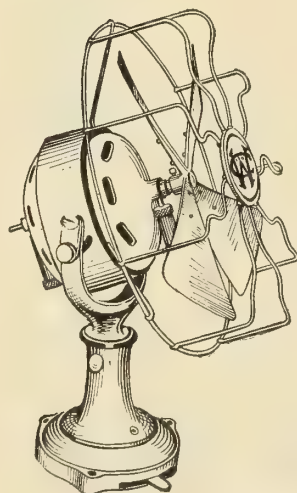
# Chapman & Walker Dealer Talks

This time we want to impress upon you the advantages of placing your orders *early* in preparation for the

## APPROACHING FAN SEASON

Avoid the troubles you had last season

Don't take chances this year in having your fan orders delayed and then coming along to you when the season is half over. Make sure of your order **early**—make sure of it **right now**. Send in for our "Special Future Delivery" contract form. It insures the delivery of your fan order in plenty of time for the beginning of the fan season.

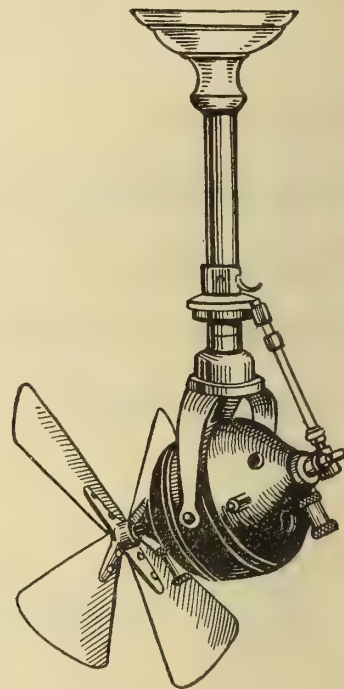


Oscillating Desk Fan

The MARK



of QUALITY



Self Rotating Ceiling Fan

We have many different styles and sizes to choose from, consisting of oscillating and stationary desk, wall and ceiling types. This year we are quoting special low prices for direct import orders.

Send us your inquiries early and make sure of early and prompt delivery.

*Ask for a copy of our illustrated catalog*

# CHAPMAN & WALKER, Limited

118-120 Richmond St. W., TORONTO, ONT.

VANCOUVER

MONTREAL

WINNIPEG—C. L. Trimingham, 206 Nanton Bldg.



# Electrical Decorations For Rent

We make a specialty of High Class Decorations for Street Fairs, Carnivals, Celebrations, Centennials, Old Home Weeks, Street Conventions, Conclaves, Parks, Buildings, Auto Shows, Balls, Fairs, Dances, Banquets, Industrial Expositions, Food Shows, Christmas and New Years, etc.

Our decorations are elaborate, appropriate and refined. We carry a complete line of Electrical Set Pieces, Signs, Streamers of Lights and Bunting for all Lodges, Orders and all occasions. Get our prices and designs.

## Electrical Decorative and Equipment Company

70 Lombard St. - Toronto, Ont.

Long distant phone Main 3634

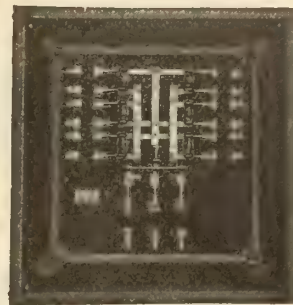


Trumbull  
Switches  
and

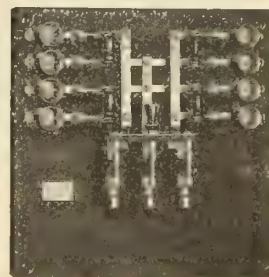
## Panel Boards

These switches and panel boards embody a number of patent Trumbull features that will effect a big saving in any wiring job.

Ask your Jobber and send to us for catalogue.



Panel and Box only.



Panel for Plug Fuses.

The Trumbull Electric Mfg. Co.  
Plainville, Conn., U. S. A.

# F A N S

## The Last Call for June Delivery

A

We have just received a large import shipment of desk, bracket, oscillating and exhaust fans from which we are now filling orders.

N

( We also wish to impress upon the trade that we carry a complete line of separate parts for repairs. )

If you have not already placed your order get our prices and discounts for June delivery.

Sole Canadian distributors for

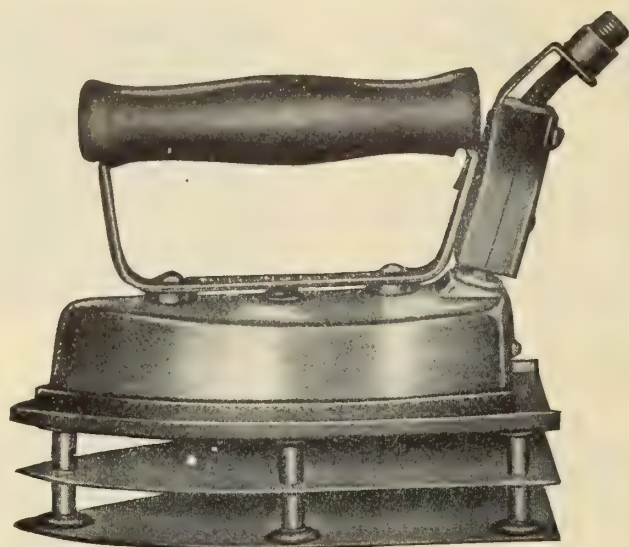
**"CONDOR" LAMPS**

S

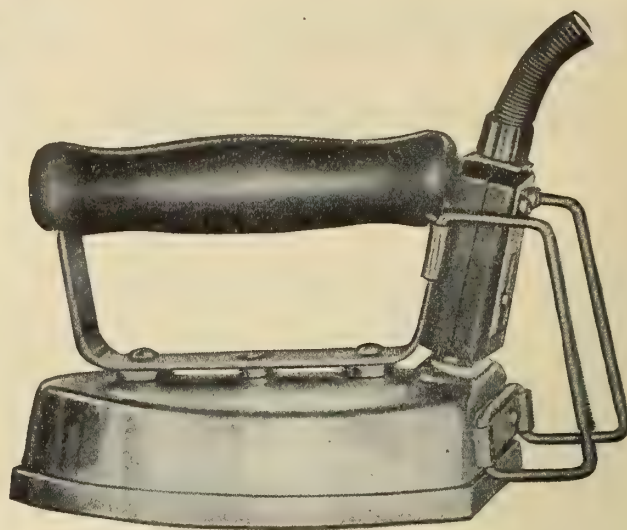
**C. H. Basters & Company**

22 College St. :: TORONTO





F 13-A with separate ironing stand.



F 13-B with permanent heel stand.

# Guaranteed Flat Irons

WITH

# Calorite Leaf Heating Units

Each of these models is the Calorite Leaf Unit design—the recognized standard of five years.

The only difference between these two irons is that the F. 13 B iron has a permanent attached heel stand.

Our nearest District Office will gladly furnish further information, and latest prices.

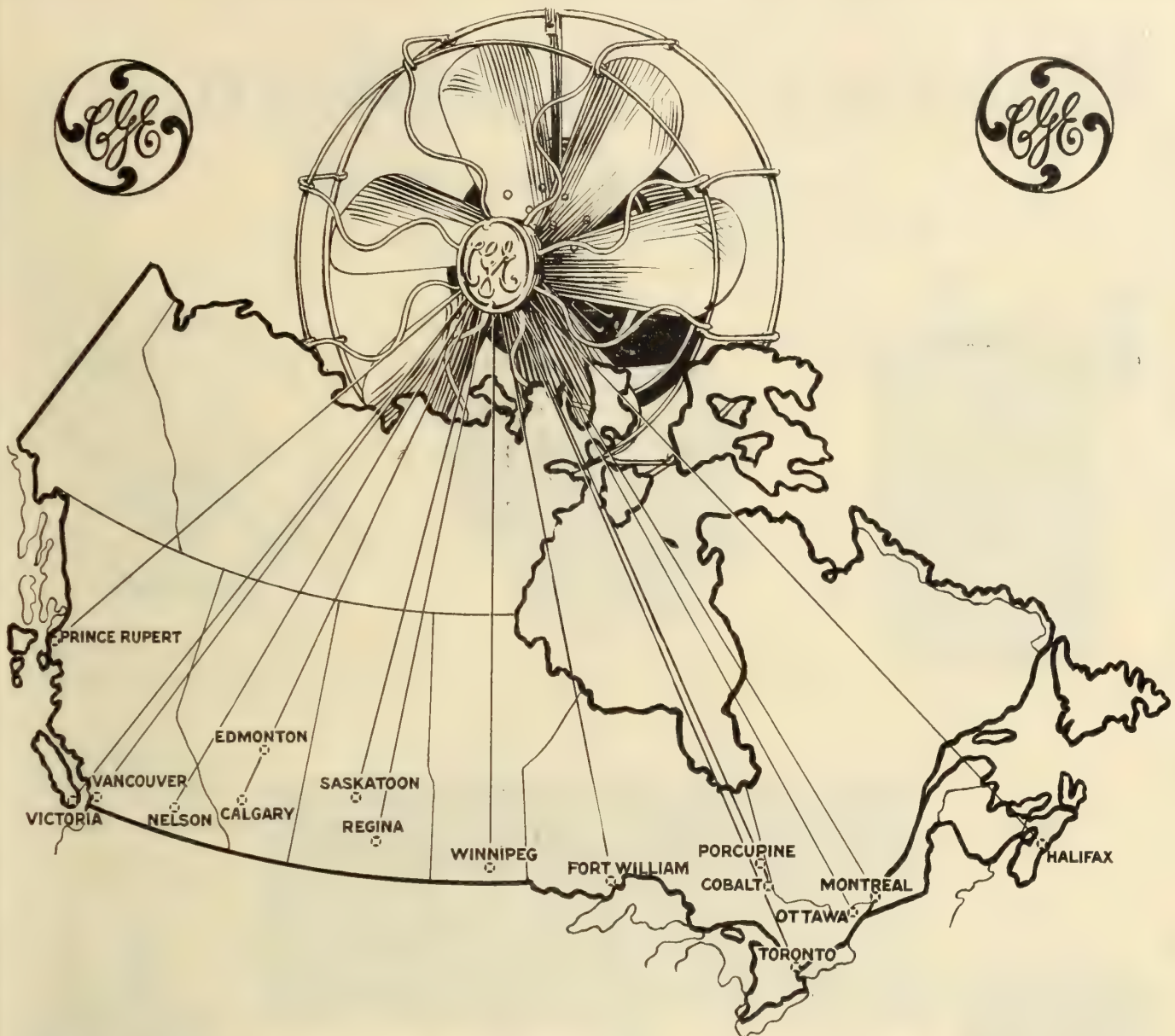
## CANADIAN GENERAL ELECTRIC CO.

LIMITED

*Manufacturers of Electrical Apparatus and Supplies  
for Railway, Light and Power Purposes*

Head Office: Toronto. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert





## FROM COAST TO COAST

The C. G. E. Fan is recognized as the Standard of Quality and Appearance.

Place your orders now before the thermometer reaches 100 in the shade and your customers are begging for fans.

All our district offices carry a well-assorted stock.

Write today.

## CANADIAN GENERAL ELECTRIC CO. LIMITED

*Manufacturers of Electric! Apparatus and Supplies  
for Railway, Light and Power Purposes*

Head Office: Toronto. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert.



# Moloney Transformers

## are Real Transformers

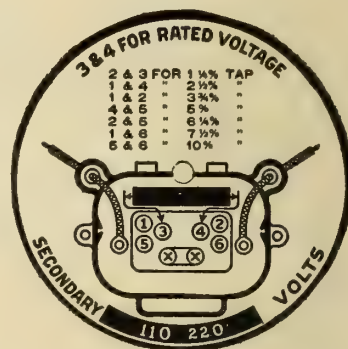
*Built for Heavy Duty and Continuous Service*



Pole Type (1 to 50 K.V.A.)



SANGAMO METERS  
Built like a Watch



Brass Plate twice the above size placed in cover of Transformers shows connections for compensating taps.

*Shipments From Stock*

**Ice Proof  
Outdoor  
Sub Station Units**

(Ask for Data Book)



33,000 Volt P.M. Switch Heavily Coated with Ice

**High Tension Outdoor  
Sub Station Switching  
Equipment.**

Write for  
Technical Bulletins



Out door High Tension  
Substation Transformer  
22,000 volts and upwards.

## Transformers for All Purposes

**Product Unequalled    Service Unsurpassed**

**Quick Shipments Made to Meet Emergencies**

*Send for our new illustrated catalogue*

Type E. Water Cooled  
1,000 to 9350 K.V.A.

# Moloney Electric Company of Canada, Limited

**WINDSOR, ONTARIO**

Factories at Windsor, Ont. and St. Louis, Mo.

901 Electric Railway Chambers, Winnipeg, Man., Can.  
1001 C.P.R. Building, Toronto, Ont., Can.

401 Lake of the Woods Building, Montreal, Quebec, Can.  
221 Rogers Building, Vancouver, B.C., Canada

**Complete Stocks at WINDSOR, WINNIPEG, VANCOUVER**



## Wagner Starterless Polyphase Motor



Self starting under heavy loads A motor especially adapted to automatic and remote control systems. It lessens the cost and simplifies the installation.

If you operate a pump at a distance from the control switch you will appreciate the advantages of this motor.

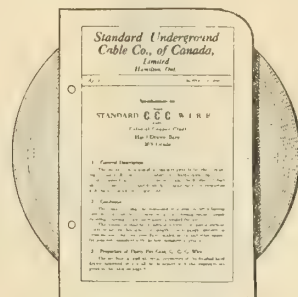
Bulletin 10213



**Wagner Electric Manufacturing Company**  
of Canada Limited - Montreal

57 Guardian Bldg.,  
Montreal

1222 Traders' Bank Bldg.,  
Toronto



## This New Bulletin

has been published for your information and should be in your files. It gives complete information regarding the properties and characteristics of 30 per cent

## Colonial Copper Clad Wire

TRADE C.C.C. MARK

If you are interested in copper clad wire for bond wires, bare wires or strands, rubber insulated or weatherproof wires, write our nearest office for C.C.C. Specification Bulletin.

**Standard Underground Cable Co. of Canada, Limited**  
Hamilton, Ont.

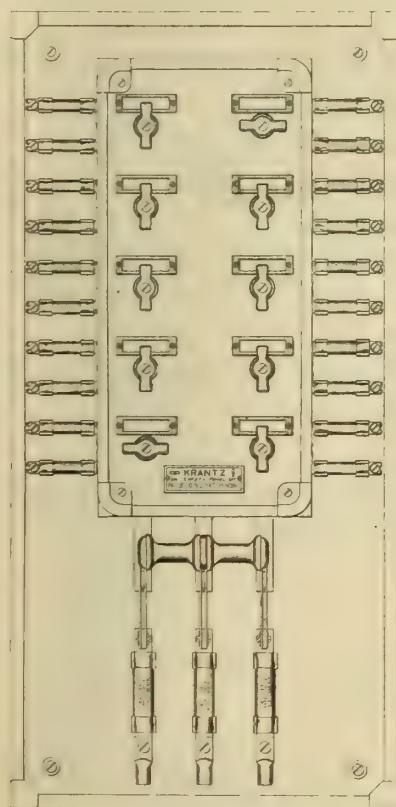
Boston, Mass.

Montreal, Que.

Seattle, Wash.

Winnipeg, Man.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Accessories.



Krantz Safety Panel  
Without Trim

On the Largest Installations in  
Canada You Will Find the Name

# KRANTZ

on

## Panelboards and Switchboards

### We Manufacture

Safety Panels, Metering Panels, Knife Switches, Switchboards of Standard and special designs.

The closest examination will convince you that our product is equalled by none although copied by many.

We are recognized leaders in switchboard and panel design and our engineers are at your service.

Have you received our latest Bulletins?

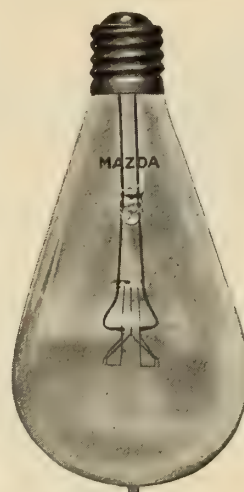
**The Canadian Krantz Electric  
and Mfg. Co., Limited**

67-71 Adelaide St. West - TORONTO, ONT.

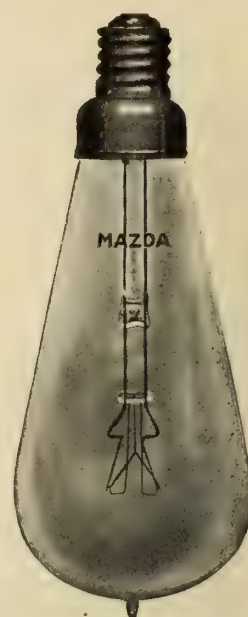


80 and 100  
Candle Power

250 Candle Power



400 Candle Power



600 Candle Power

# Sunbeam Mazda

## High Efficiency Multiple and Street Series Lamps

The latest improvement in Sunbeam High Efficiency Mazda Lamps consists in a change of filament construction from the loop filament to the closely coiled wire, and the introduction of an inert gas in the bulb. The efficiency of these lamps is between 25 and 33% higher than the former Mazda lamps and the quality of their light is far superior. The New Series Lamps in the following sizes are recommended to replace the former lamps of similar size:

80	candle power,	6.6 & 7.5	Amperes
250	"	"	6.6 & 7.5 "
600	"	"	6.6 & 20.0 "

100	candle power,	6.6	Amperes
400	"	"	6.6 & 20.0 Amp.
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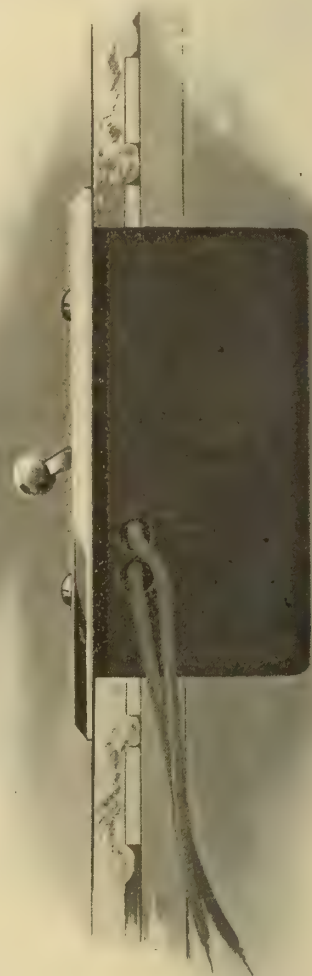
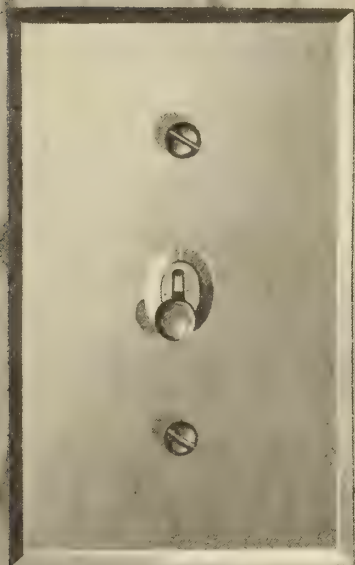
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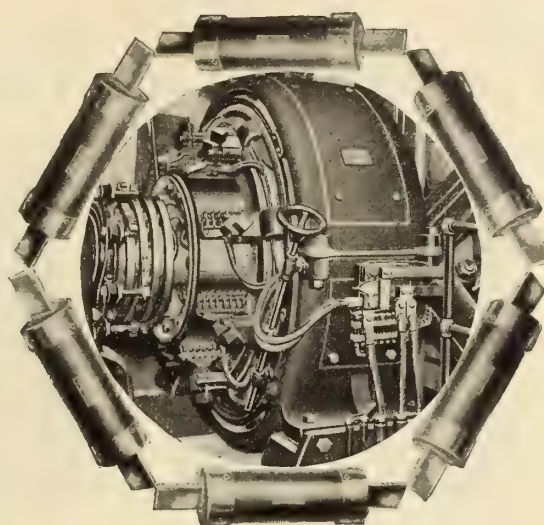
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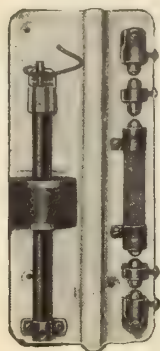
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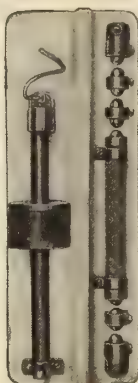
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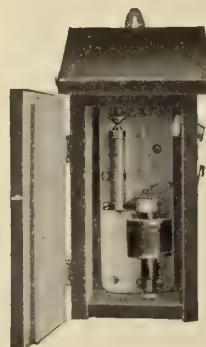
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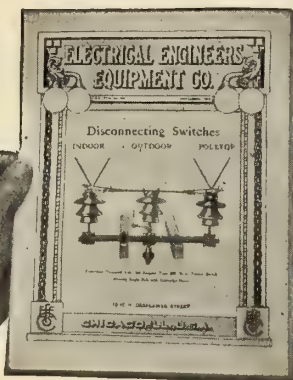
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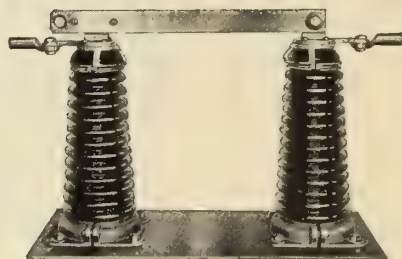
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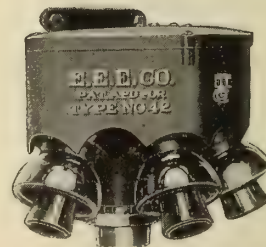
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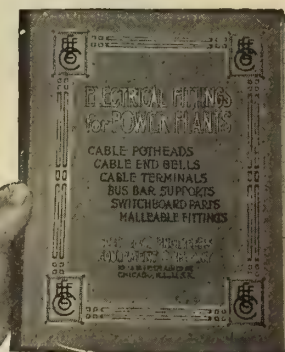
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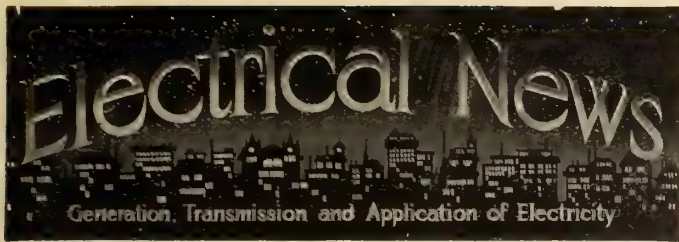
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Toronto, July 1, 1914

No. 13

## The C. E. A. Convention

It can easily be said that the entertainment provided for the delegates to the 24th Annual Convention of the Canadian Electrical Association, by the Montreal members, excelled anything that has been provided in the past at these conventions. Montreal electrical men, at all times noted for their hospitality, made a special effort on this occasion to send the delegates away satisfied that they had crowded the greatest possible amount of entertainment into their three days' visit.

On Wednesday morning, the first day of the Convention, a general reception was held in the ballroom of the Ritz-Carlton, at which the delegates and their wives and friends were welcomed by the officials of the city of Montreal. At eleven o'clock the ladies were taken in automobiles to the Country Club, one of the most beautifully situated and best appointed clubs in the Dominion, where they were entertained to luncheon. Leaving the Country Club they proceeded for an early afternoon "Scotch" tea to the steamer "Saturnia," one of the Donaldson liners, where they were courteously received and lavishly entertained. An hour later the party boarded the steamer "Ascania" of the Cunard line, and again every possible consideration for the comfort of the delegates was shown. During the afternoon a life-saving demonstration and a fancy swimming and diving contest including a number of interesting races, was witnessed from the steamers by the delighted visitors.

Returning to the Ritz Carlton, dinner was followed at 8.30 by a bridge and five hundred party for the ladies, with music and refreshments, and suitable prizes for the winners and near-winners. At nine o'clock one of the most successful smoking concerts in the history of the Association was held in the basement for the visiting delegates. The variety

of the entertainment and the versatility of the entertainers deserve special mention, and delighted the delegates well into the small hours.

Thursday showed no abatement in the efforts of the entertainment committee to provide a pleasurable time for the ladies. Visits were made starting at ten a.m. to points of interest throughout the city, including the Art Gallery (said to be the finest in Canada), the Bell Telephone Exchange, the mountain top (representing a magnificent natural park of some four hundred acres overlooking the city),



S.S. Saturnia, Donaldson Line.

McGill University, etc. In the afternoon the gentlemen were given a holiday, and at three o'clock everybody proceeded first by the Montreal Tramway system to Lachine; and then by special steamer "Duchess of York" through the Lachine Rapids, one of the most beautiful and thrilling trips on the St. Lawrence River. A circuit was then made of the Montreal Harbor, and the party finally disembarked at the Vickers Dry Dock, a magnificent work at present under construction. After a minute inspection of this dock, the



Dry Dock "Duke of Connaught," Maisonneuve.

party proceeded again by the Montreal Tramway cars to Dominion Park where an open-air dinner was served from 7.30 to 10. Return to the Ritz Carlton was made by street car at a comparatively early hour.

In this connection a few remarks on the new dry dock will be of interest:—The shipbuilding and repair works of Canadian Vickers Limited, promises to be one of Montreal's



most important industries. This very large plant is at present under construction at Maisonneuve, including a number of shops necessary to the building and repairing of vessels. As a beginning to the enterprise, the dry dock "Duke of Connaught" was built in England and recently brought by tugs to this country. The combined length is 600 feet over all, with a exterior width of 135 feet, and a clear inside



The Tomb of the Wire.

width of 100 feet. This dock is so built as to be separable lengthwise into three complete parts, so that one, two or three of the sections can be utilized according to the size of the vessel to be docked.

Practically all the equipment, when installed, will be electrically operated. That portion of the works in operation is equipped with individual and grouped motors with current supplied by the Montreal Light, Heat and Power Company at 11,000 volts. Ordinarily, current will be provided in the dry dock from the shore, but when the dock is away from the basin, provision is made for the generation of a supply by steam-driven units. A special power house is at present under construction which will include transformers, rotary converters, etc. The electrical equipment is being manufactured by Vickers Limited, Sheffield, and by the Electric & Ordnance Accessories Limited, Birmingham. The lighting throughout will probably be by mercury vapor lamps of a capacity of 3,500 candle-power each.

On Friday morning the ladies were left free to entertain themselves along St. Catherine Street, Montreal's famed shopping centre. In the afternoon the cars of the Montreal and Southern Counties Railway were placed at the delegates' disposal and a delightful trip it was to Chambly and return in time for afternoon tea at the Ritz Carlton. During the afternoon souvenirs of the Convention were presented to the ladies which consisted of a piece of silver, with the

famous Henry Birks stamp. At 7.30 the delegates were entertained at the theatre party at the Orpheum Theatre, and afterwards an informal dance was held at the Ritz Carlton.

An interesting contribution to the entertainment proceedings was made by the G. M. Gest Company who are constructing the elaborate underground system in Montreal. This was designated the "Tomb of the Wire," and took the form of an artistic one-storey pagoda erected over one of the transformer pockets are forming an entrance to the pocket. The underground enclosure was exquisitely decorated in tapestries, and sweet music, discoursed from an unseen source, delighted the visitors while they partook of the hospitable refreshments supplied by Mr. Stannard. This item constituted one of the most interesting and instructive features of a most complete three days' entertainment programme. The illustration shows Dr. Herdt (on the left), Chairman of the Electrical Commission of Montreal, and Mr. D. B. MacIntyre, Superintendent of Construction for the Commission.

Congratulations are certainly due Mr. Lawford Grant, the Chairman of the Entertainment Committee, whose activity and enthusiasm were in evidence every minute of the three days of the Convention. Scarcely less enthusiasm however was shown by Mr. R. M. Wilson, Mr. Julian C. Smith, Mr. P. T. Davies and many other well-known electrical men of Montreal, who gave themselves up unreservedly to assure the visitors a good time.



Convention Headquarters—Ritz-Carlton, Montreal.



# The Twenty-fourth C. E. A. Convention

At the Ritz-Carlton, Montreal, one of the Most Successful in the History of the Association  
—Over 400 Delegates—Resume of Papers program and Discussions

The twenty-fourth Annual Convention of the Canadian Electrical Association held in Montreal at the Ritz Carlton on June 24th, 25th and 26th was one of the most successful in the history of the Association. Something over four hundred delegates registered and the quality of the papers presented during the three days' programme was of a particularly excellent and interesting order. As far as possible every phase of the electrical industry was covered. As is almost inevitable, the time allotted for discussion was insufficient, but with what little time the delegates had at their disposal, some very interesting points were brought forward. Below we give a brief resume of the different papers and in a number of cases, the discussions which followed them. The report will continued in our next issue.

The action of the Montreal Tramways Company, and of the Montreal and Southern Counties Company in placing their street cars at the disposal of the visiting delegates was highly appreciated. The visitors are also under great obligation to the Cunard and Donaldson steamship lines for their hospitality during one of the afternoons, and to the Lachine Transportation Company, the Vickers Limited, and the Dominion Park Company for their continued hospitality on the second day of the Convention.

A number of interesting souvenirs were presented, including a paper weight representing a tungsten lamp by the Canadian Laco-Philips Company; a tobacco pouch in the form of a rubber heel, by the Walpole Rubber Company; a lead pencil by the Robert Reford Company on which were inscribed the words "Let this remind you to use the Cunard, Donaldson and Thomson lines for both passenger and freight service"; and the special Convention souvenir which took the form of a silver bottle opener. This latter was suitably inscribed, drawing attention to the date and location of the convention.

## MODERN SWITCHING EQUIPMENT

By L. B. Chubbuck

The speaker showed a large number of lantern slides representing various switching equipments installed in a number of well-known Canadian companies. As the slides were presented Mr. Chubbuck pointed out various items of interest in the switchboard design and in the particular types of equipment installed.

## LEGAL ASPECT OF INTERFERENCE BETWEEN SYSTEMS OF ELECTRICAL COMPANIES

By G. H. Montgomery, K. C.

This paper was practically a resume of all the past Canadian legal decisions affecting electrical companies in their relations to one another or to the municipalities they serve, and is, we believe, the first attempt to classify such decisions. In this connection the paper is of practical interest to every operating company as it will indicate the attitude of the judiciary during the past few years in the interpretation of the various forms of franchise agreement and will thus suggest the probable interpretations of the future.

### Discussion

In the discussion which followed, Mr. McDougall outlined the decision which had been made in connection with the T. E. L. Company and the City of Toronto, and described the company's recent victory before the Privy Coun-

cil, where their rights to go into all the newly annexed parts of the city have been firmly established.

Mr. Dion described conditions in the City of Ottawa where there is a satisfactory working arrangement between the municipality and the company to use the same transmission poles. Mr. Chambers described the legal fight which he had recently gone through with the municipality of the town of Truro. The town had been granted an injunction to prevent certain work being carried on by the company but had dropped the matter at that point. Mr. Bird made the suggestion that the legislative committee of the association should be instructed to collect and file all legal information of this sort respecting Canadian private companies; this brought a remark from the president that it had already been decided by the general committee to follow this matter up.

## SAFETY FIRST

By J. F. H. Wyse

Mr. Wyse describes in a very interesting way the historical growth of the now world-wide movement towards the preservation from accident of the "human" being whether as employee, employer or every day citizen. The work of the Ontario Safety League is explained and its object in few words stated to be "the saving of life and limb." It is pointed out that quite aside from the humanitarian point of view the protection of our citizens means adding to our commercial assets. It is shown too that in the long run it is cheaper to protect the workman from accident than to compensate his family for the loss of their bread winner.

As indicating the extent of the work already accomplished by the Ontario Safety League, of which Mr. Wyse is organizer and engineer, the list of affiliated interests shows some 20 or 30 companies, associations, bureaux, etc. The work that has been done in Ontario is already bearing splendid fruit and it is stated that one of our street railways, by letters to automobile owners and teamsters alone, reduced its street traffic accidents in one month by about 40 per cent. The article concludes with some very excellent recommendations regarding the safeguarding of equipment in central stations and in line operation.

In his historical sketch Mr. Wyse also describes the work that has been done on the continent of Europe where museums of safety appliances have been established in many prominent centres, to stimulate the public interest. In this respect North America has apparently very much work yet to accomplish but, considering that the movement is young, and that very excellent results have been obtained with comparatively little advertising, the future looks exceedingly bright.

The introductory remarks of Mr. Wyse were especially significant:—

"Mr. President, Ladies and Gentlemen: I am sure we all feel a deep interest in the subject of reducing accidents, and when we consider that there is a fatal accident in Canada and the United States every sixteen minutes, we realize it is our constant duty to be on the alert for our own, and our brother's safety.

"In 1905, a little girl, about twelve years of age, a companion of my eldest daughter, going home from school, ran behind a street car and was instantly killed by a car coming in the opposite direction. This brought the matter very much home to me, and I then and there made up my mind,



if the chance ever offered to reduce accidents, it would not be a lost opportunity.

"This opportunity offered shortly afterwards, in 1906, when the Ontario Railway and Municipal Board was formed, my firm, then Wyse & Middlemist, was appointed the Board's Engineers, and I was given charge of investigating Provincial Railway accidents and making recommendation for their prevention. Assisted by the most sincere efforts of Mr. Walter McRae, Master Mechanic of the Toronto Railway Company, the Toronto cars were equipped with every device applicable to prevent accidents; this, and the intelligent and careful policy of Mr. James Forest, Claims Agent of the Toronto Railway Company, has resulted in the Toronto trolleys having a minimum of fatal accidents, for any city its size in Canada and the United States, only 13 for last year (1913).

"The reward and satisfaction in the work of accident prevention lies in the knowledge that there are men, women and children to-day, well and happy on your streets, who, had it not been for your efforts in the great movement of "Safety First" would be six feet under the surface."

### THE GROUNDING OF DISTRIBUTION CIRCUITS

By S. Bingham Hood

Mr. Hood is a firm believer in the grounding of neutrals at practically all voltages. His paper recounted a number of experiences in the earlier days of grounding neutrals at the lower voltages which all tended to show that lack of success was due to poor grounding. It was pointed out that the greatest care should be taken in this work and that proper connection should be made at frequent intervals with water mains or other metallic underground systems. Mr. Hood is equally convinced of the necessity of grounding 550 volt lines, both from an operative and from a safety standpoint. At 2,300 and 4,000 volts he considers grounding desirable from an operative standpoint and considers also that the life hazard is likely to be less. Concluding, the paper states that in the higher transmission voltages grounding, as in the other systems, is equally desirable. We reproduce Mr. Hood's paper in full.

#### Discussion

In the discussion which followed Mr. Hood's paper Mr. Dion spoke of the N. E. L. A. regulations regarding the compulsory grounding of circuits up to 150 volts with the option of doing practically as you like above that voltage. Mr. Dion suggested that it would be well for the Convention to go on record as recommending that grounding to water pipes, only, be made compulsory; this on account of the troubles which often arose from poor grounds where other means were used. Mr. Fisk raised the question as to whether a gas pipe would not make a sufficiently satisfactory ground and received the answer from Mr. Hood that where this pipe was 3-ins. or more in diameter a gas pipe should be quite satisfactory. Further contributions to the discussion were made by Mr. Coleman, Mr. MacLachlan and Mr. Mudge. Mr. Mudge moved as follows that a "grounding" committee be formed, and suggested Mr. Hood as Chairman.

The subject of grounding of distributing circuits has been warmly debated for many years but is now in a very different position from what it was two years ago—as the grounding of all circuits up to 150 volts is now insisted on by the National code and by the law of the Province of Ontario. In view of the above I would move that one of the standing committees of this Association for the coming year be a committee on Grounding of Distribution Circuits. Appropriate lines along which this committee might work are as follows:—

1. Obtain information as to Dominion and Provincial

laws on the subject, and keep in touch with any legislation either Federal or Provincial which may be made.

2. Obtain information from every electric light and power company in Canada, whether a member of the Association or not, as to their experience in this matter including list of deaths and accidents which have occurred both before and after grounding, their methods of grounding and troubles incidental to same, and how they have been overcome.

3. Obtain information from N. E. L. A. and other authoritative bodies, both American and European, on the subject.

4. Draft recommendations for the advice and instruction of light and power companies as to advisability and best methods of grounding.

5. Make a definite campaign to convince every company in Canada whether a member of this Association or not, that grounding should be carried out, assisting where necessary by advice and information.

6. Assist where necessary in convincing municipal authorities that no harm can come from grounding to water piping systems.

There may be other lines along which this committee might work. By keeping closely in touch with the N. E. L. A. committee on this subject the amount of work of this committee will be minimized as the N. E. L. A. Committee have done much valuable work along this line. The work of such a committee will cost something and an appropriation may have to be asked for to do the work but a few hundred dollars spent in this way will, without doubt save thousands of dollars to Canadian central station companies.

### THE VALUE OF ELECTRIC HEATING DEVICES TO THE CENTRAL STATION

By Harold S. Brown

This paper dealt chiefly with domestic electric ranges and their cost of operation though interesting figures were also given regarding the loads developed by electric flat irons, cooking in hotels, restaurants and other public institutions, and various other household and industrial applications. Discussing the electric flat iron it was particularly emphasized that the peak load of the iron does not coincide with the average peak load of central stations. For example, an instance was quoted where there were 4,200 irons in use in a certain city in which the peak domestic power load occurred at 10 a.m. and actually exceeded the lighting load peak of the evening. This indicates how important such a load can be made to a central station which is running very light during the day time.

Mr. Brown's figures on domestic ranges demonstrate very forcibly, by comparison, the advances that have been made in the last few years. Test figures were given showing that the cost of cooking for an average family of 5 is around 3 kw.h. per day, which with a rate of 3c or less is apparently able to compete with gas. Daily cooking records for one week, using the same range, and preparing different menus each time, for five persons, show a total consumption for the 21 meals of a shade over 25 kw.h., or at a cost, on a 3c rate, of 75c. This figures out equivalent to .239 kw.h. per person per meal or, at 2c, a cost of .7c per person per meal. That these menus were thoroughly representative may be seen from Table 1 which we reproduce on p. 49. It is to be noted that this was for a family of five persons. For larger families it may be taken for granted that the cost would be slightly less per individual and for smaller families probably slightly more.

#### Discussion

A lively discussion followed the reading of this paper. Mr. Leacock asked about the reported saving in shrinkage with electric cooking. Mr. Brown said that popular reports in this respect were, he believed, somewhat exaggerated



but Mr. Moore stated that his experience showed that the shrinkage in electric cooling was about 8 per cent. as compared with from 20 to 22 per cent. with gas or coal; this was largely accounted for by the better construction of the electric oven which made it practically impossible for the moisture to escape.

The question of the value of electric cooking as a load for the average central station, was raised by Mr. McDougall and Mr. Dion. Both agreed that the tendency of electric ranges was to superimpose an extra peak on the already troublesome peak which occurred from five to seven in the evening. Unless it could be shown that the cooking peak would come at an earlier or later hour in the day, it was not evident that this was a desirable load for central stations to cultivate. Mr. Bird expressed the opinion that rather than discourage the use of a piece of household apparatus that promised to become very general and useful, it would be better to adjust the rates. It was not absolutely necessary to make money from the sale of these articles, and the moral influence of encouraging the use of ranges would be such as to encourage also the more general use of other electrical equipment.

An interesting contribution to the discussion was made by Mr. Ratcliffe Hulme who spoke particularly of the number of fires which are caused by electric irons. He believed it would be well to inaugurate a campaign of caution in these matters, as there was no reason why, if ordinary care was taken, there should be any more fires from electric than with ordinary flat irons.

Other speakers included Mr. Wills, Mr. MacLachlan, Mr. Magalhaes and Mr. Ormond Higman. Mr. Wills pointed out that under certain conditions, especially among the working classes, the heaviest meal of the day was prepared at noon, which would prevent super-imposing the cooking peak on the evening lighting peak; under these conditions the cooking load would be a decided advantage. Mr. MacLachlan raised the question of the high cost of ranges and made a plea for a range at such a rate that the average man could afford to purchase it. At the present time it is the cost of the range, rather than the cost of its operation which prevents more extensive developments in electric cooking. Mr. Magalhaes suggested the use of a two-rate meter to encourage the use of the ranges at off peak hours. Under this condition also, the company would be guaranteed a fair rate for the current consumed at or near peak load.

Mr. Higman delivered a short, enthusiastic address on the advantages of electricity in cooking and water heating over any other kind of heat. He stated that from actual experience he was satisfied it was utterly impossible to do as good work with wood, coal, or gas, as with the electric range. Also, where a rate of 2.2c is given, as in his own city, there is no difference in operating costs. In a general way, if the electrical range is economically used, it can be made to compete as to cost, with gas. Mr. Higman also replied to a question asked by Mr. McDougall earlier in the discussion, about water heating by electricity. Mr. Higman was able to cite a case where electric water heating had been installed and cost data kept, which showed that the operation at present is no more expensive and is much more satisfactory than with the Rudd gas heater which had been used previously.

#### CO-OPERATION IN THE SELLING OF COOKING AND HEATING APPLIANCES

By W. B. Johnson

Mr. Johnson's paper dealt chiefly with the subject of co-operation between central stations and electrical dealers and expressed the opinion that this phase of the industry

had not received the consideration it deserved. The good will of electrical dealers means much to the central station. Mr. Johnson stated that it is not so much the price of electrical appliances that is responsible for their sale as the resale on the part of the consumer for that particular article. The campaign should therefore be along the line of educating the people on the practical value of the different kinds of electrical equipment.

It is a very difficult question whether the companies should or should not sell electrical appliances, or whether this industry should be left entirely to the dealers. In any case, however, lighting companies should do all they possibly can to promote the sale of appliances by window demonstrations, personal solicitations, advertising, etc. The co-operation of architects should also be obtained so that they will specify outlets for electrical appliances. Mr. Johnson also believed that companies should quote a fair rate for current for electrical ranges so as to encourage their use, and expressed a hope that it will not be many years until every summer home within reach of a line of a central station will contain an electric range.

In the discussion which followed the reading of Mr. Johnson's paper, remarks were contributed by Mr. Coleman, Mr. Smith, Mr. Scott, Mr. MacLachlan and Mr. Dion. The discussion turned chiefly on the subject of the selling price of lamps of different sizes, the general feeling being towards a uniform price. In one or two instances a view was expressed that these lamps should be the cheapest which produce the most satisfactory revenue.

#### MAXIMUM DEMAND DETERMINATION AND ITS RELATION TO THE COST OF SUPPLY OF ELECTRICAL ENERGY

By P. T. Davies

Mr. Davies' paper took it for granted that the basis of sale of electrical energy should be on a demand basis and that the use of the demand has little effect on the cost of production. The maximum demand of the individual customer is found to be a most important feature in the cost of supply, on account of the effect of this demand on the diversity factor of the supply system. Mr. Davies quoted a number of illustrating figures to show the small proportion which actual production costs bear of the total cost of supplying electrical power. The remainder of the paper consisted mainly of a discussion of the determination of the demand.

The methods at present in use were discussed briefly, namely:—

1. Demand based on instantaneous peak.
2. Demand based on lowest point of usage during a stated interval.
3. Average load during stated interval.

The first is considered a hardship on the consumer. The second is a hardship to the company, especially as it is possible for the customer, by careful manipulation, to defeat the ends of the contract. The third method is described as the one generally used and the discussion in the paper deals chiefly with the means used to obtain the demand by this method.

The discussion of this question is classed under three headings:—

1. Method of demand period.
2. Number of demands to be taken.
3. Whether a demand, once established, shall remain the billing basis for the balance of the contract unless exceeded.

These questions are taken up more or less mathematically, and worked out according to the theory of probabilities with very interesting results.



### SOME NOTES ON STEAM RAILWAY ELECTRIFICATION

By J. A. SHAW

Mr. Shaw's paper described the three systems available as follows:—

1. The three-phase alternating, not suitable for general electrification on account of requiring two trolley wires with the resulting complications.

2. Single-phase alternating current.

3. The 2,400 volt direct-current.

The question is discussed under the headings:—Supply of power, cost of installation, cost of operation, telegraph interference, possible difficulties with 2,400 volts, comparison of systems and conclusion.

The conclusion favors direct-current operations as is shown by his answer to the question, "What is gained by the use of Single-Phase? The answer is that it does not save in cost of installation or operation; its application is not more flexible; it introduces a locomotive that is more complicated; and it reduces cost of sub-station attendance at the expense of locomotive maintenance and consequent reduction in reliability.

### INTERRUPTIONS ON LONG DISTANCE TRANSMISSION LINES—THEIR ORIGIN AND MEANS OF PREVENTION

By P. Ackerman

This paper classifies the causes of interruption on long distance transmission lines as, (1) lightning troubles; (2) sleet and wind; (3) birds and other outside interferences; (4) unexpected insulator failures; (5) short circuits on distributing systems. Lightning troubles are stated to be responsible for from 80 to 90 per cent of the total number of interruptions.

Mr. Ackerman's paper discusses particularly the possibilities of improving our insulators and defines a series of tests which had for their object the determination of the ratio of flash-over to puncture voltage, the removal of the danger of burning-off of cables, the effect of the power arc and the gradual weakening with time of the porcelain from which the insulators are constructed. The paper expresses the belief that by a close study of these conditions from 80 to 90 per cent of the line interruptions will be eliminated.

The status of the selective relay protective equipment at the present time is also discussed. The necessary characteristics of the selective overload protection system is stated to be (1) A definite time characteristic for the relay on heavy short circuits—that is a certain definite time to trip the switch no matter how heavy the short circuit current may be; (2) Accuracy; (3) Reliability. The opinion is expressed that with the more recent apparatus these necessary characteristics are being obtained.

The paper concludes with the following optimistic remark: "Hope can be entertained that the insulator problem will be solved, at least to such a point that the chief causes of present transmission line troubles will be eliminated and that with some further development in relays such selective action may be obtained that total interruption will be safely guarded against."

Mr. Ackerman's paper was discussed by Mr. MacLachlan, Mr. Hood and others.

### HIGH EFFICIENCY, INCANDESCENT LAMPS AND THEIR APPLICATION

By H. J. Madgick

This paper dealt with the wonderful improvements that have taken place in the making of lamps during the very recent past, pointing out the development in efficiency over the old carbon lamp which consumed about 3 watts power candle, as compared with the present nitrogen-filled lamp

which consumes, under the most ideal conditions,  $\frac{1}{2}$  watt or less per candle-power. It was pointed out that in addition to the very economical consumption of these new lamps, the distributing characteristics are such as to add still further to their economy in operation. The different types of lamp at present on the market and their satisfactory results were described. Series street lamps of the lower wattages (down to about 80 watts) and multiple lamps of 750, 1,000, and upwards, watts consumption give entire satisfaction, both as to cost, operation and maintenance. In answer to a question, the speaker stated that the latest type of nitrogen lamp would burn equally well in any position.

### SOCIETY FOR ELECTRICAL DEVELOPMENT

Mr. Wakeman, the president of the Society for Electrical Development was present, and addressed the delegates on Thursday morning. Mr. Wakeman outlined briefly the work of his society and explained a number of interesting details in connection with the progress already made. The watchword of this society is "Co-operation." That man will be the greatest business success who best knows how to co-operate. The object of this society was to bring together central station, dealer and contractor so that these may work in unison for their mutual benefit in the development of the electrical business market. At the present time 1,382 companies have been included in the movement and the sum which they set out some time ago to raise, namely, \$200,000, has now been pledged. Mr. Wakeman instanced a number of cases where they had been of assistance to isolated central stations. Central stations are instructed in the best method of getting business and under certain conditions are even supplied with skilled solicitors for a given time. Mr. Wakeman stated he had been told by one of the member companies that morning, that the solicitor sent to them had resulted in sufficient business being added to pay their subscription to the society for the next ten years. Answering a question of Mr. Scott, the speaker stated that an effort was being made to include electrical inspectors in the society so that these may work in unison with the other members.

### DOMINION TESTING LABORATORIES

Mr. Ormond Higman, head of the Department of Electrical Inspection for the Dominion Government, spoke of the work of his department during the past year. He stated that the branches at present under construction in Vancouver and Winnipeg are making excellent progress and that the Vancouver branch is very nearly completed. These will compare favorably with other electrical testing laboratories on the continent and will include up-to-date machinery. Each branch will also have on its staff a skilled instrument maker.

Answering a question by Mr. Dion regarding the status of The Maximum Demand Meter, Mr. Higman stated that as yet only one had been presented for verification. Though the question had not been definitely raised, it was not likely that the Government would pass any meter with a maximum rating of less than a ten-minute period. This seemed a somewhat arbitrary decision to Mr. McDougall who pointed out that under certain conditions it was often deemed advantageous to sell current on shorter peaks than ten minutes. Mr. Higman replied that his reference had been to the smaller consumer which it was the special desire of the Government to protect.

Mr. MacLachlan rose to express the appreciation of the Association that Mr. Higman should have shown so great interest in the Association's work as to come to Montreal and give them this interesting address. A vote of thanks was enthusiastically carried.



# Some Notes on Steam Railway Electrification

By J. A. Shaw, Canadian Pacific Railway Company\*

The determination of the preferable system for electrifying a section or branch of a railway, involves that best adapted for general service. If successful, their installation may be extended as electrification of other portions of the road may prove desirable. This will depend on the success obtained in economical and reliable operation. It is necessary in view of further extensions to select a system suitable for general conditions to obtain interchangeability in rolling stock. Possibly different systems may be used on different parts of a road, but each will have to operate under all conditions on the district on which it is installed.

## Systems Available

Three systems now exist which include all which need be considered in view of the present state of electrical development. One, the three-phase alternating, is not suitable for general electrification, on account of requiring two trolley wires, with the resulting complications and the peculiar characteristics of the motors employed. The remaining two systems are single-phase alternating current, and the 2,400-volt direct current.

The single-phase system has been used in the electrification of the New York, New Haven and Hartford Railway from New York to Stamford, and is now being considerably extended. It has also been used on a number of light railways, notably the Spokane and Inland. Abroad it is in use on the London, Brighton & South Coast Railway, the Swedish State Railway and others, and has been adopted by the German, Swiss and Austrian State Railways as their approved system, although it cannot as yet be considered as completely through the experimental stage.

The 2,400-volt direct current system is a development from the 600-volt system, which is practically the standard in all street railway and interurban work, and which has been so successful on that field. The electrification of the New York Terminals of the New York Central and the Pennsylvania Railroads, the Atlantic City Line of the Pennsylvania, the New York Subway, and all elevated railways have also employed this system. Abroad it has been used on the Lancashire and Yorkshire Railway and in general under conditions similar to those in this country. During the past three years a number of light railways have been installed using 1,200-volt direct current, in most cases, however, using 600-volt motors, and from the experience obtained, the 2,400-volt system has been developed, using 1,200-volt motors, and this system has now been in use on the Butte, Anaconda and Pacific Railway, preparatory to a further use of it on two divisions of the Chicago, Milwaukee and Puget Sound Railway, for the past 10 months. A lower voltage installation at 1,500 volts has been in service over three years on the Piedmont Railway in South Carolina.

## Supply of Power

It is possible that in the majority of cases for years to come that power will be generated for locomotive purposes alone, without considering its use for other purposes. However, electrification will be made possible more through cheap power being available from existing power plants, where if a separate plant had to be erected it would be too expensive. Possibly in the future power plants will be constructed at points where commercial power is not available, but even in that case at other points on adjoining divisions commercial power might be obtained, and to permit of uni-

form equipment the power generated would either have to be uniform with that purchased or the latter converted to the character required. Throughout the West and in the Montreal district, 60-cycle, three-phase transmission is practically universal, and while 25-cycle, three-phase current is employed on the Hydro-Electric and Toronto-Niagara transmissions from which 25-cycle single-phase could be obtained by stationary transformers, balancing apparatus would be required. In view of the tendency to use 15-cycle in place of 25-cycle current in single-phase electrification and the remoteness of general electrification in Ontario, it is reasonably safe to assume that converting apparatus will be required for either single-phase or direct-current installation. The application of 15-cycle generators in 60-cycle power stations or of frequency changing apparatus to furnish single-phase current, while possible, does not actually change this assumption, as the increased price asked for by the power companies equals the cost of conversion by the railroad in addition to requiring the erection of separate transmission lines.

## General Arrangement

The general arrangement of the two systems may be outlined as follows:—

### Single Phase

- A 1. Power line of supply company.
- A 2. Conversion station at one or two points per division - furnishing single-phase current from motor-generator apparatus and step-up transformer for raising potential.
- If power lines are available at several points on division, number of conversion stations may be increased, and length of transmission lines correspondingly reduced.
- A 3. Transformer line from conversion stations to transformer stations.
- A 4. Transformer station in which high voltage single-phase current is transformed to 11,000 volts for trolley line.
- A 5. Trolley line and bonding.
- A 6. Electric locomotives or motor cars.

### Direct Current

- D 1. Power line of supply company.
- D 2. Transmission line to sub-stations. Where supply company power lines are available at several points on division, sub-stations may be conveniently located at such points, and length of transmission line correspondingly reduced.
- D 3. Sub-stations in which three-phase power is converted to direct current by motor generator apparatus.
- D 4. Feeder line to which direct current is supplied to trolley line.
- D 5. Trolley line and bonding.
- D 6. Electric locomotives or motor cars.

## Cost of Installation

An inspection of above table shows that as a general proposition certain of the items are practically common to both systems. Transmission lines A-3 and D-2 will be required for the entire length of the division if power were received at one point: whereas if power were received at several points, while several single-phase conversion stations could be installed, that would not prove practically econom-

\*Read before Montreal C.E.A. Convention.



ical, and with direct current there would be a saving in the transmission line required. The transmission line for single-phase current costs 20 per cent. more per mile than that for three-phase, so that it is entirely fair to the single-phase to consider the cost of transmission lines equal.

The trolley line and bonding are practically the same. For single-phase, higher insulation is required on account of the higher voltage and the surging which occurs. With the improvements that have been made in the manufacture of insulators, the difference would not exceed 10 per cent. of the cost of the trolley line.

The conversion stations and transformer stations A-2 and A-4 for single-phase, will correspond to the sub-stations D-3 for direct current. For heavy traction work on the Chicago, Milwaukee & St. Paul Railway, where it is proposed to handle 1,600 tons on 1 per cent. grades, the sub-stations will be located from 18 to 24 miles apart, the feeder being 1,000,000 cm. Considering a direct current section having sub-stations 20 miles apart, the distance between transformer stations for single-phase current will depend on the worst conditions that should be permitted to occur. Thus with the direct current with a voltage drop of 50 per cent., trains could be handled at one-half speed with full tractive power. With single-phase the maximum drop permitting this condition would be from 20 to 30 per cent. The latter figure will be taken as most favorable to single phase, and the distance apart of stations calculated: 1st, when the number of trains on a section is proportional to its length; 2nd, when the same number of trains are concentrated at the centre of a section irrespective of its length. The spacing of the stations can also be calculated when the efficiency is the same for both systems, the number of trains per mile of track being the same. The results are as follows:—

Limiting operating conditions, trains uniformly distributed or number proportioned to length of section . . . . .	30 miles
Limiting operating conditions, same number of trains at centre of section . . . . .	45 miles
Equal efficiency, number of trains proportioned to length of section . . . . .	30 miles

The limiting operating condition with the number of trains proportioned to the length of the section is evidently most important from a general railroad standpoint, and transformer stations, say 33 1-3 miles apart, would apparently give substantially equal service compared with direct-current sub-stations 20 miles apart. The total capacity of the direct-current sub-station will exceed that required in the conversion station, since each sub-station must be able to carry the load of the trains that may be starting in its vicinity. The total cost of the single-phase stations is, however, increased by that of the transformer stations, which cost one-third as much per kilowatt capacity as the conversion or sub-stations. The two systems are thus equal in cost when the sub-station capacity with direct current is 44 per cent. greater than the conversion station for single-phase. In some cases the difference is not sufficient, but lines will not be electrified on which traffic is insufficient to render the load reasonably uniform. As in the case of the transmission line and trolley the single-phase was more expensive; in this case the direct current will be in general slightly higher—the net results being very closely the same.

The remaining items are: A-6 the single-phase locomotives, D-4 the direct-current feeder, and D-6 the direct-current locomotives. The feeder proposed is of 788,000 cm. area, costing at 18 cents per pound, \$2,250 per mile or \$2,500 per mile erected. The cost of the locomotives will vary according to the type and capacity, but based on direct-current locomotives costing \$40,000, those for single-phase current will cost \$60,000, so that if one locomotive is used for each

eight miles of track, the total cost of the two items is again substantially equal.

The net result is that where power is obtained from three-phase distribution, the cost of electrification by single-phase or direct-current is substantially the same. This is confirmed by several careful independent estimates. With direct current the expenditure on feeder copper and sub-station apparatus is balanced by the slightly increased cost of the trolley and transmission line for single-phase current and the much greater cost of the locomotives.

### Cost of Operation

Cost of operation is affected by the efficiency of the system, the cost of operation of the sub-stations and the cost of the maintenance of the locomotives and other apparatus.

The efficiency of the system will determine the cost of the power supplied, and, if the movement of the trains and the power they each consume is known, could be calculated with considerable accuracy. When power is purchased, especially water power, the cost depends on the peak load during certain hours, and trains will be operated to reduce this as much as possible. It is therefore difficult to forecast the train distribution. There is, however, no general evidence to how that greater efficiency may be obtained with single-phase than with direct-current equipment. Several records of actual service show that with direct-current under similar conditions the results are more economical than single-phase. This is especially so when the power per car mile is considered on account of the greater weight of the single-phase equipment. From what we have already learned and figures published, it may be safely assumed that on any section of a railway on which there is sufficient traffic to justify electrification, the power required by direct current will not exceed that required for single phase.

The cost of sub-station maintenance and operation is greater for direct current. On a 100-mile division there would probably be five (5) sub-stations, each containing moving apparatus which requires attention as against one for single-phase system. Each of these sub-stations would cost from \$3,000 to \$4,000 per year, or say \$18,000 per annum, against \$4,000 for the single-phase station. It is doubtful whether the wages cost of \$2,000 per year per station, or \$10,000, is a proper charge against the direct current. On main line work it will be absolutely necessary to arrange to cut out any portion of the road on which accidents may occur, and for this purpose attendance will be required. Trains must be moved away from any section temporarily disabled to prevent congestion, and of the \$14,000 additional cost it would appear entirely fair to estimate that about \$8,000 is the most that would be entailed by the sub-stations. This is more than equalized by the greater cost of maintenance of the single-phase locomotive. Direct-current locomotives are being maintained for 3¼ cents per mile, of which 2 cents is entirely separate from the electric motor, control, etc. On the single-phase locomotives, the cost has been higher, but it is hoped to reduce it to between 5 and 6 cents. For short distances the direct-current locomotives as used out of New York will handle a train that requires two single-phase, and if this were allowed for, the difference would be very great. The new switching and freight locomotives on the New Haven, it is stated, have been maintained for a comparatively low figure, but they have as yet not been in service sufficiently long to give a final value. The construction of all single-phase locomotives is far less sturdy than that of direct current, on account of the difficulty of keeping the weight down to a reasonable amount, and the construction is far more complicated. It cannot be expected, therefore, that they can be maintained for a lower percentage of their total cost. A fair difference to assume



is that cost cannot be taken at less than 2 cents per mile for locomotives of equal power, say 1,000 h.p. each. Considering a division with 1,000,000 miles per year, or \$20,000 at this figure, so that the cost of operation and maintenance of sub-stations is more than taken care of by the increased cost of maintenance of equipment. The single-phase locomotive is also considerably heavier than the direct-current for equal power, and this is especially true when motor car equipment is considered. This increase in weight means a correspondingly reduced train load, unimportant on level districts, but of appreciable amount on heavy grades. It also entails an additional expense for power which is serious in light passenger or motor car service. There is, of course, a possibility that 2,400-volt direct-current apparatus will cost more to maintain than 600 or 1,200-volt, but there does not appear to be any reason to fear its becoming excessive. While there is no doubt that the New Haven have had more electrical trouble than the New York Central and the cost of repairs has been higher, due to the mechanical construction of the locomotives rather than to the electrical equipment. This mechanical construction is, however, necessitated by the use of the single-phase motor. While there is no reason why the same construction should not be employed with the 2,400-volt direct-current system as with the 600-volt. In general, there is no reason to expect the cost of operation with the single-phase system to be less than that with the direct current.

#### Telegraph Interference

One of the objections to the use of single-phase current is its effect on telegraph and telephone wires. It is stated that this may be overcome by the use of suitable apparatus or by moving the wires to about 200 feet from the power lines. It is questionable whether either of these modifications will entirely eliminate the difficulty, and it is certainly an objectionable feature. With direct-current the corresponding difficulty arises from electrolysis, but this is far less important in railway than in street railway work, in which it has been largely overcome.

#### Possible Difficulties With 2,400 Volts

The above discussion considers that 2,400-volt direct-current will prove equally satisfactory as 600 or 1,200-volt installations. In a system that has not been thoroughly demonstrated in practical service, there are some features from which trouble may be experienced, and these are discussed as follows:—

The simple and strong design of the direct-current locomotive is partly due to the use of geared locomotives for freight service and gearless for passenger service. The construction which has been adopted and which is practically necessary for single-phase locomotives of any size, supports the motor entirely independent of the wheels, the latter being driven through springs or connecting rods, thus reducing the dead weight to that of the wheels and axles alone, while retaining the same total weight on each wheel. The centre of gravity of the locomotive is also raised to a point approximating that general for steam locomotives. From experiments conducted on engine and tender trucks and the experience of maintaining track under various types of locomotives, it is safe to assume that the dead weight of 9,000 to 10,000 pounds per axle on gearless locomotives and the slightly greater weight on geared, does not, for the services in which they will be respectively used, appear likely to affect the cost of track maintenance sufficiently to justify the additional expense and complication involved in reducing it. In view of the greater total weight of the single-phase locomotive it is very doubtful whether its effect on the track will not be greater than the direct-current locomotives, even though the dead weight per axle is higher in the latter. In-

creasing the height of the centre of gravity reduces the lateral shocks on the rail, but this action is caused by these shocks in steam locomotive design being absorbed by the vertical movement of the springs. It will be unfortunate if electric locomotive design cannot be developed in which these shocks are absorbed by springs, or frictional methods of restraint, so that the simplicity which should accompany the application of motors to drive the wheels of a locomotive may be retained; there is no reason to doubt this being accomplished. Should it prove impossible, the direct-current locomotives would become more complicated and approach the single-phase more closely in cost, the difference being probably 25 per cent. in place of 50 per cent.

The question of current collection at 2,400 volts at high speed has been experimented with, but not fully demonstrated as yet in service. It has been found practical to collect 200 amperes at 60 miles per hour from one roller trolley without injurious sparking, which at 2,400 volts equals 480 kw. Two trolleys can be located 20 feet apart, thus permitting 960 kw. on one locomotive. This question is important, but there seems little question of its being solved satisfactorily. The control of 2,400 volt current does not appear to present any difficulty. Contactors will be arranged to break the current in series, and from results in operation there seems no reason to anticipate any more trouble with 2,400 volts than with 600. Maintenance of motors may be higher with 2,400 volts than with 600 volts. The motors will, however, operate under 1,200 volts each, and the fields in both motors will practically be at ground potential. Twelve hundred volt motors have operated interurban work for five years without indicating any increased cost of maintenance, and while this has been in a dry climate, the forced ventilation to be employed in railway work will give very closely the same condition. The 2,400-volt motor will have the same capacity to stand heavy starting load, the same freedom from commutation trouble, and in general the same ability to stand the severe service imposed upon it by locomotive or traction work that the 600-volt motor has been proved to possess.

The operation of fan and compressor motors on high voltage has to be properly worked out. There are no doubt some difficulties in this respect, but they should certainly be overcome by experience.

#### Comparison of Systems

It has been shown that on the assumption that the 2,400 direct-current and the 11,000-volt single-phase current system each operate as satisfactorily as their advocates claim, that there is comparatively little difference in their cost of installation and operation. Each is equally flexible, each will operate and in all probability give a high degree of satisfaction compared to steam locomotives. The principal difference is that, with the direct current a larger portion of the cost of installation is in feeder copper and conversion apparatus, and less in the locomotives, and a larger portion of the cost of operation is in the sub-stations, attendance and maintenance in place of locomotive maintenance. This of itself should prove decidedly to the advantage of the direct-current system, as the sub-station apparatus is stationary and can be carefully maintained, and the simpler and cheaper the locomotive the less danger there will be of a breakdown. In addition, the investment in copper is permanent, while that in locomotives may rapidly depreciate with any new developments. There are, in addition, some minor points worth attention which may be referred to.

The regulation of speed on the single-phase system is in many ways preferable to that on the direct current. By drawing current from the transformer at the voltage suitable to the speed and power required, all speeds are equally efficient, and the use of resistance in the circuit is avoided.



This is an exceedingly ingenious method, but it is doubtful whether it is of great practical importance. While the direct-current motors have only two full-power efficient speeds, decreased power can be obtained at higher speeds than either of them by field control with very small loss in efficiency. This would apply particularly in passenger service, since in freight service the characteristics of the motor are such that it would not be required. The use of a transformer on the single-phase locomotive permits the operation of the motors at low voltages, and on ungrounded circuits. There seems, however, no reason to fear the use of high voltage on the direct-current motors, or danger, providing it is properly insulated. There has certainly been more trouble on the single-phase from grounds than on the direct-current, and it appears to be entirely a question of proper insulation. The relation between the speed of the motor and the power it will develop is different for single-phase and direct-current. Taking two motors which will develop the same power at a given speed, the direct-current will develop greater power at lower speeds and less power at higher speeds than the single-phase motor. This is the reason for the success of the direct-current motor in traction service. It can exert a greater pull without injury and is less liable to damage from overheating when starting a heavy load than any other type of motor. It is also this feature which makes the gearless locomotive a possibility for passenger service, as it enables a motor of reasonable size to start a passenger train without the use of gearing to furnish the necessary power. Direct-current motors can certainly be constructed to handle passenger trains at high speed if desired, so that in this respect the advantage is greatly in its favor. The direct-current motor has obtained its reputation for ruggedness from its capacity to withstand heavy loading without injury.

### Conclusion

If in place of discussion the relative advantage of single-phase and direct-current traction, the start is made from the direct-current system with its simple and strong electrical apparatus developed after years of experience by simply an increase of voltage, and assuming that this increase does not lead to unforeseen difficulties, the question becomes, What is gained by the use of single-phase current?

It does not save in cost of installation or operation.

Its application is not more flexible.

It introduces a locomotive that is more complicated, in which the motor is necessarily far more expensive and elaborately constructed, and which weighs considerably more than one for direct-current.

It reduces cost of sub-station attendance at the expense of locomotive maintenance, and consequent reduction in reliability.

The general advantages to be gained by electrification are too well known to bear repetition, but it might be mentioned from the data now becoming available from those installations now in operation that results obtained confirm estimates very closely. The engineers of the Chicago, Milwaukee & St. Paul Railway, estimate that at least a saving of 25 per cent. will be made in operating costs on the 440 mile division now to be electrified in the Western States, and part of this saving is confirmed by the showing already on the Butte, Anaconda & Pacific Railway, where power cost has been found to be but one-third of the previous coal cost. The decision to electrify the suburban lines of the Pennsylvania Railway about Philadelphia, was made to relieve the existing congestion by increasing the capacity of terminal 15 to 20 per cent., or sufficient to relieve the situation for the next five or six years and at less expense than any other method.

## Grounding of Distribution Circuits

By S. Bingham Hood, Toronto Electric Light Co.\*

To ground or not to ground has been a question occupying the minds of central station engineers, and the columns of the technical press, for many years.

This question has progressed from the point where it was thought to be criminally negligent to allow a ground on a circuit to that of being thought equally guilty not to allow a ground.

If we go back a few years we find the National Code forbidding the operation of any circuit with a ground on it, then allowing it by special permission; next suggesting that it be grounded; and, finally, in the last edition, making grounding compulsory up to 150 volts, and optional above this pressure.

Almost the entire argument upon which grounding is based is that of reducing the life hazard. What more sound basis for argument could we wish for? However, this is the smallest part of the argument, considered purely from the central station standpoint. True, none of us wish to see our customers transferred to Kingdom Come, or the other place, but we do wish to increase the reliability of our system.

In a system of any size, particularly where the much desired interconnected network of low-tension supply is used, it becomes almost a physical impossibility to keep grounds off the system for any length of time. Many of us here can remember the old days of the ungrounded network (and, I regret to say, some of us are still in the old days), where John

Smith's basement light is hard up against a water pipe and he, unknowingly, tests all his neighbor's wiring insulation at double its normal voltage. About this time Mrs. Jones sets her electric iron down on her gas stove (the iron, as usual, being broken down in its interior anatomy) while she interviews the ice man.

Mrs. J. postpones her ironing and Smith falls down his cellar stairs in the dark. Now what happens? Mrs. J. picks up her iron, looks it all over, outwardly, and sets it down where it belongs—on its stand on the ironing board; then sends for the electrician, who calls, looks wise, and says, "Your plug is too small," and puts a 20 amp. on a branch circuit which is only good for six amperes, but will safely carry 15 any old day, and may, as a special favor, now be fused and approved for 10. Bill, 75 cents.

Smith does not believe in electricians, and can't find a new fuse plug, so uses the old one backed up with one of our much-despised Canadian coppers. In addition to curing his trouble, he has established a "permanent and effective" ground on our system and don't care a hang whether it is approved or not.

Probably the next ground is outside somewhere where it has no fuse to blow, and friend Smith loses his cent together with some other of his household effects.

Now, when the Code finally allowed grounding, many of us saw daylight ahead and thought we had the answer to the whole problem by simply putting a collar on our stray cat

\*Read before the Montreal C.E.A. Convention.



and chaining him fast at the middle point of our potential distribution. We hunted up some old gas pipe, drove it a few feet into the ground, hooked it up to our neutral and stood back to await the results.

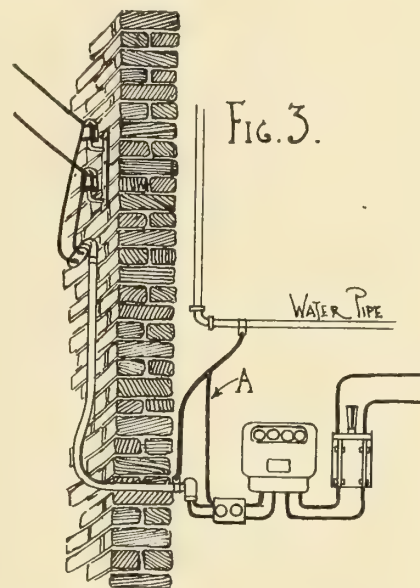
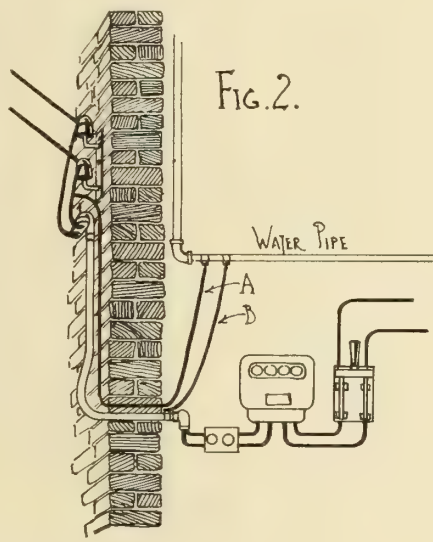
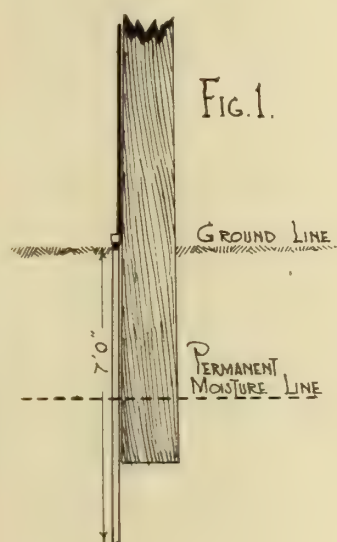
What was the result? Somebody comes along on a nice damp day and leans up against our salvation and immediately dreams a few new dance steps. We send out a trouble man who finds the ground pipe charged, and to find out how heavily, jumps it onto a fire hydrant or car track. Bang! and it is all over and the trap is set for the next victim. This happens a few times and the ground pole gets a bad name. Result, our trouble man cuts off the ground wire and we are back where we started and the old cat jumps over the fence again.

I went through this experience about ten or twelve years ago, and I suppose nearly all of you have had a very similar one or are now in the midst of this continuous performance.

Now, gentlemen, I am going to tell you what I kept a state secret for some years, to save my own neck. If my old chief were here he would now understand why I got such good results from these grounds in my district, and why other districts were meeting with worse than failure. I carefully picked the points for my ground connections and, having all my neutrals tied together, had about a dozen favorite

have made numerous resistance tests on this class of ground, and have found the resistance to vary from five or six ohms, where a  $\frac{3}{4}$ -in. pipe is driven seven feet into wet ground, to as high as 180 ohms on a similar pipe in same ground after a long spell of dry weather. Such a ground can only be figured as to effectiveness under its worst condition. A fair average resistance would be 60 ohms. Considering buried plates, ground cones and similar devices, the average resistance will be about one-half of this owing to their being buried with their active surfaces planted deeper and generally in permanently moist earth. For the same reason their maximum and minimum resistances will not vary nearly as much as in the case of a driven pipe. The chief defect of these latter class of grounding devices is their inability to withstand corrosive action of most soils for a long period of years. This, together with their higher first cost, makes them almost prohibitive for use for the purpose for which they are designed.

Referring to Fig. 1, we have a typical driven pipe ground in which we have seven feet of pipe in contact with earth in wet weather, and about one-half this is extreme dry weather. Under these conditions our ground is only one-half its maximum effectiveness under the latter conditions of moisture. If the soil is composed of sand and gravel we lose practically all



points which I knew would work. I will not attempt to describe all of them, but can recall two which were particularly effective. In one, our pole line rested right on the edge of a twelve-inch water main. One pole bore so hard on the side of this that I protected it by a good-sized cast lead plate formed to fit the curvature of the pipe. By accident (?) one end of our ground wire got cast into this plate.

In the other case the owner of a large building closed his contract before he built the building, and to avoid having the service conduit show on the front wall had us build it into the wall as it went up. The 2/0 neutral, again by accident, passed through the wall of the conduit about in the centre of the brick wall and branched off between the courses and finally wound up, literally, around the main water service just before it entered the basement.

The results gained in this way have firmly convinced me that the only permanent and effective ground is direct to a water or other piping system laid in the ground, and to attempt to get reliable protection in any other way is a sheer waste of good time and money.

At first sight it may not appear clear why these driven grounds give such average poor service. Upon closer investigation, however, it becomes very clear as to why they fail. I

our protection in dry weather and reclaim but little in wet weather, as path of lowest resistance is then in top soil only.

Now, assuming a small net work protected by one driven pipe with a resistance of 60 ohms, we get an accidental ground on one side of our three-wire system, or on the other wire from that to which ground is connected on a two-wire system. Immediately our ground wire and pipe is raised to 110 volts above earth potential. The potential then decreases to zero through the earth contact with the pipe. From tests made it has been found that this zero potential condition is not established until we get at least a foot away from our pipe. In other words, we have a cylinder of earth with the pipe for its axis. The outer walls of the cylinder are at zero potential and the axis 110 volts above, or below. This explains why a person standing close to a pole where ground exists will receive a shock and not be actually touching either the pole or the ground wire. In high-tension transmission systems using iron poles, or even wooden poles in wet weather, one can get a severe shock by walking within several feet of the base of pole or tower.

One of the first requirements of a successful ground connection is that it must pass sufficient current at 110 volts to at least blow a branch fuse of 10 amperes. One of these pipes will not blow, under average conditions, more than a two



ampere fuse; therefore we must provide at least five driven pipes on each section of our secondary network.

The second requirement is to blow the largest fuse in our primary network in the event of a cross occurring between primary and secondary systems. This fuse would probably be, in a fair size system, 150 amperes. One driven ground would pass about 40 amperes, and we must have at least four ground connections to insure proper protection. If the cross occurs in the transformer or on a small fused branch primary line, then one driven ground will protect. This is, however, an exceptional condition, and to obtain absolute protection our grounding system must be of sufficiently low resistance to pass the heaviest current possible to obtain, and also to open up the protective device controlling this heavy current. Applying this rule we will find that, to prevent our ground leads becoming charged with low potential current, due to an accidental ground on the other side of secondary network, we must provide a very low resistance path. For instance, if the heaviest main fuse of any customer is, say, 150 amperes, we will need about 80 driven ground pipes to make our system self clearing. It is clearly impracticable to get such results by this means of grounding, as it would require a ground on every pole along a stretch of line nearly two miles in length, even if we neglect the resistance of such a long length of neutral conductor.

Aside from the impracticability of such driven grounds there is another factor of danger, to both our employees and the public, which enters into their use when installed at the pole base, as generally located. If, in the event of a high-tension cross, the primary protective device fails to open the ground wire and pipe becomes charged to 2,300 volts potential and any one touching it would probably receive a fatal shock. If the condition is maintained for any appreciable time the leakage from ground pipe at ground line to the moist ground line area of the pole will result in setting the pole on fire, and not only damage our construction but attract attention to the unusual condition and very possibly induce someone to touch the pole, or ground wire, who would otherwise not be called upon to go near it.

The second and ever present danger in this method of grounding, and one which exists independent of the ground resistance, is that of having any uninsulated grounded conductor on any wood pole line upon which high-tension lines are strung. This danger is one which affects our employees to the greatest extent, as they are practically forced to handle high-tension lines on what is to all intents and purposes a metal pole. To ask any lineman to do this is little short of criminal, and numerous fatal accidents have resulted from this practice.

Now compare these crude and prohibitively expensive, as well as ineffectual methods of grounding, to that of grounding directly to a water main on the consumer's premises.

Assume we have a No. 8 service line and that the ground is made by tapping the neutral service line at the building bracket and carrying it down the outer wall and into the basement, where it is clamped to the water pipe. We have a total resistance of at most one-fourth ohm and can pass an instantaneous current of over 400 amperes at our lowest operating potential. Here the capacity for protection is governed entirely by the safe carrying capacity of the ground and service wire. Number 8 wire will carry 60 amperes for a considerable time without dangerous heating, and we can get absolute protection under the most severe conditions from four of such grounds.

#### Using Service Conduit

The steadily growing standard practice of bringing service into the basement through a service conduit or standpipe simplifies grounding very materially. Figure 2 shows such a service with ground wire carried down the outside and

connected to water pipe as suggested in the Code. This, I think, shows clearly the unnecessary and unreasonable economic waste of this proposed method. The ground wire (A) is clamped to the water pipe. Immediately adjacent to it is another clamp connected to the grounding wire required for the service conduit. The neutral wire inside the standpipe is of same potential as ground wire outside, and can just as well be made to serve as the grounding lead as well as the neutral. This service conduit neutral in small installations will probably not be larger than number 12, so more grounds will be required to give safe carrying capacity on a large system. The proper and most economical method of grounding, and one which I have used with uniform success for a number of years, is that shown in Fig. 3. Here we have the service conduit grounded (by the wireman who installs the job) to the water pipe. The neutral ground (A) consists of a short piece of wire, of same size as service conduit wire, tapped from neutral line lug on service block to a convenient point on the conduit ground wire. This gives a permanent and effective ground at a cost of about 10 cents as compared to probably \$1.50 if run down the outside of building, and probably \$3.50 to \$5.00 if driven pipe is used at pole. At this low cost every service can be properly grounded, as now called for in the Code and Provincial Rules, at an expense so small as to be negligible, leaving absolutely no excuse for further postponement of giving our customers, and the public at large, the protection against injury or death which they have a right to demand.

With such a system of grounding the entire expense would be covered many times over by the damages we would have to pay from one fatal accident. The central station which postpones grounding one day longer than necessary after such simple means of carrying it out are shown to exist, may expect, and heartily deserves, the severest censure and heaviest damage any court can grant.

In those cases where service enters by the old method of porcelain tubes through an upper wall of the building, suitable grounding becomes somewhat more complicated. The usual method is to run a fairly heavy wire, No. 8 or larger, down the outside wall and through into basement to water pipe. It frequently happens, however, that suitable grounding points may be found much closer to the service. For instance, the ground wire may be carried down to opposite a bath-room, where a small unbushed hole may be drilled through wall and ground wire clamped to a section of exposed piping under some of the fixtures of the bath-room. Again, the vent pipe may pass through the roof near the point of service attachment, in which case the ground wire is clamped to vent pipe by a large copper clamp band. Another method would be where a building is piped for hot water heating, in which case the overflow from expansion tank generally passes through the upper wall or roof. The ground wire can be clamped directly to this overflow pipe.

Some of these methods might not be desirable if only one ground were depended upon; but if we ground every service, we can rest assured that a very large proportion of the ground connections could be more or less defective without materially decreasing the protection to our system or the public safety.

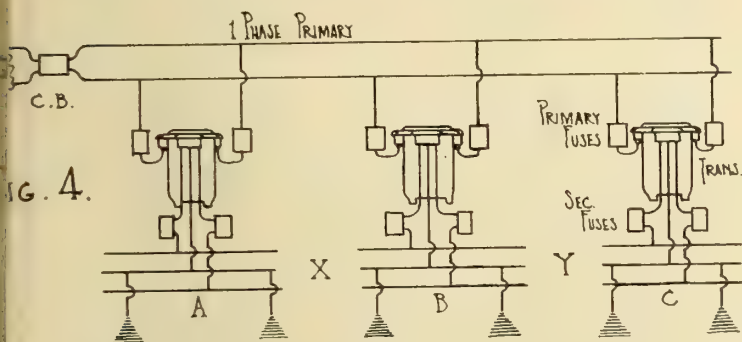
In order to convince our various inspection departments of the absolute safety and reliability of such grounding methods, I would mention that on the system with which I am connected there are over twenty-five thousand customers so protected, and there has never been one indication where any damage or injury has occurred to either persons or property which could be even remotely traced to the grounding method used.

During a period of three years under this method of operating, the total expense for repairs to transformers, meters, service equipment and customers' installations, caused by insulation breakdowns due to both lightning and high-tension crosses, has been less than two thousand dollars.



The period immediately preceding this was one filled with trouble. Meter and transformer burnouts were frequent and serious. Every storm meant three or four transformers to replace and meters by the dozen.

The effect upon the customers' wiring was even worse. Our large secondary networks acted to distribute a high-tension cross over a large area and resulted in simultaneous breakdowns at numerous points. I recall one cross which damaged customers' wiring and apparatus in over fifty places. In this case repairs to fixtures, fittings, and decorations re-



quired several weeks' time of a large number of men and involved an expense to the company of over \$800.

Another case covering a widespread area cost over \$3,000 to repair; and smaller mixups costing anywhere from one to three hundred dollars were common.

By good luck or an act of Providence we were fortunate enough to have this damage confined to property only, none of our customers, as far as I know, having been injured in any of these catastrophes.

Surely this is evidence enough of the desirability of grounding from an economical standpoint, neglecting the humanitarian aspects of the problem.

We have further utilized this grounding to not only eliminate practically all the usual operating troubles of a large system, but to reduce our distribution investment by over \$50,000—and we are not done yet.

In order to thoroughly understand the development of the system and to show the various steps leading up to present distribution standard, we must consider each of these steps in their proper order.

Referring to Fig. 4, we have a delta connected primary system from each phase of which single phase primary distributors are taken off through oil circuit breakers. The various secondary networks, indicated as A, B and C, are shown served by a single unit, but in practice were generally each supplied by from two to six or eight units, each of these small secondary networks covering a block of considerable area. At this time it should be noted that the neutral ground connections consisted of driven pipes, three or four to a section.

From time to time additional load was obtained adjacent to the gaps between sections, as at X and Y. Investigation showed that these loads could not be properly supplied from either existing section except by running additional copper or erecting more transformer units. It was, however, found possible to carry such loads, in many cases without additional investment, by connecting these sections together and utilizing the diversity factor which was found to exist at such points. With the development of the networks these gaps were closed in one by one until an inter-connected area of from 150 to 200 kw. in transformer capacity was obtained, this condition being shown in Fig. 5.

With the old Fig. 4 arrangement the grounds were not giving good results, as they were not of sufficiently low resistance to blow customer's fuses in case of a ground on an outer on customer's wiring as previously explained. With

the interconnection of the smaller networks, giving the Fig. 5 arrangement, this trouble largely disappeared. In the event of a heavy ground or cross, however, conditions were worse than before, owing to the wider area covered by the trouble.

In order to overcome this the practice of grounding directly to water pipes, by method shown in Fig. 3, was adopted, placing one such ground connection every 300 or 400 feet on the secondary main. This immediately stopped all further trouble on the customers' wiring and largely eliminated meter and transformer burnouts due to lightning or superimposed high-tension currents. No additional primary troubles developed, and there seemed to be a slight decrease in those already known and of former frequent occurrence.

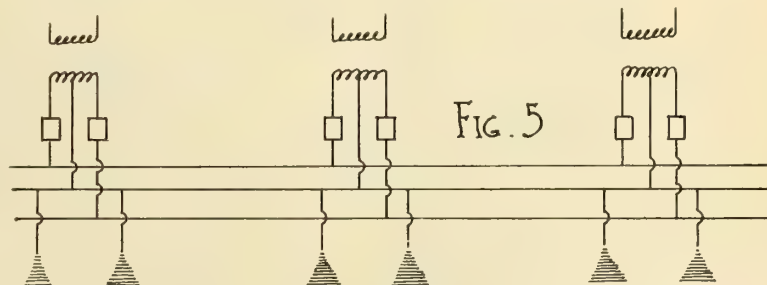
About this time it became necessary to carry, at short notice, a large temporary lighting and power load far beyond the capacity of existing feeders, and on too short notice to permit of installation of additional feeders. In order to do this we made use of a square bank of 1 to 1 ratio transformers connected delta to star, and supplied the load over an existing three-core cable on the 4 wire 3 phase system, using the cable sheath as a grounded neutral, this arrangement being shown in Fig. 6. The arrangement was found to operate so successfully that it was continued in service, and later on, when the entire system was adopted as standard practice, the three phases being run to the approximate load centre and each phase taken off as a single section supplying one particular area in which all secondary mains were interconnected. This gave three large single phase networks on each three phase outgoing feeder, each section having a transformer capacity of from 150 to 300 kw.

In several cases bad breakdowns were caused by the breaking of the neutral conductor or the four-wire primary system, resulting in voltage distortion on the separate phases.

This was overcome, as a then temporary expedient, by tapping the primary neutral to the secondary neutral at two or three points, as in Fig. 7,

Now study this drawing carefully and what do we find? There are two wires of the system covering practically the same area, on the same poles, of same normal potential to earth, and electrically connected together. Is there any good and sound reason for keeping them separate? Why not run one wire to replace the two? This is exactly what we did, and forms to-day what we know as the "Common Neutral System of Distribution." Fig. 8 shows this system as now operated, and in all its simplicity and, perforce, reliability.

By reference to this drawing you will see that we have but one wire to our primary system, with one-half the copper investment and considerably less than one-half the



chances for trouble. But one single pole section control switch and one primary fuse block at each transformer, giving an additional saving in investment and lessened chances of trouble in direct proportion to number of contacts through which current must pass.

On the secondary or low-tension side of the system we find no death-traps for our linemen, in the form of ground wires uninsulated and attached direct to poles. On the customers' service the neutral service fuse is either omitted altogether or permanently bridged. This is of particular ad-



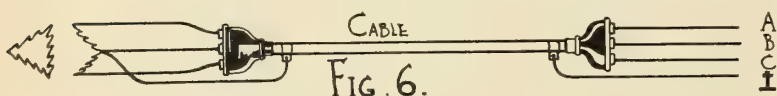
vantage where three-wire services are taken off for larger customers; as, in such cases, a blown neutral generally means a lot of burned out lamps—and Tungstens cost money.

Such a system, I believe, approaches very closely the ultimate in economy, efficiency and reliability. It would not be possible except by thorough grounding of neutrals, and, I believe, absolutely wipes out any possible objection to such grounding from the standpoint of expense. Can we, therefore, in any way defend ourselves against the inevitable consequences of non-grounding after it has been shown that in protecting the lives and property of our customers, we at the same time save ourselves a very considerable proportion of our present and prospective investment?

I would suggest that the various inspection bureaus give this question their careful attention with a view of officially recognizing it as standard practice. The inspection bureaus with which I have had to deal have in all cases unofficially approved of the method above outlined; although it is not in accord with the actual wording, however, it may be in conformity with the spirit of the Code or Provincial Rules. In other words, instead of the established rules leading the

sponsible for many, if not most, of our interior wiring failures?

If we ground this interior common neutral at numerous places, when it is installed, we absolutely prevent its ever being used for any other purpose but that of a grounded

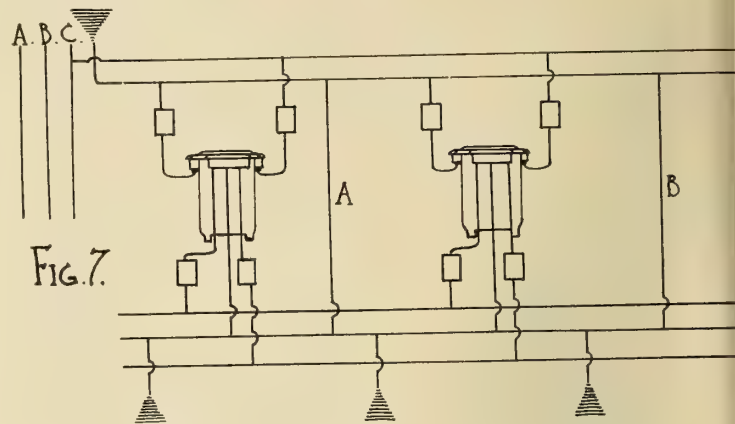


system, the system is leading the rules, and the shorter we can make the drag rope the easier pulling we will have.

As a final suggestion, allowing that our neutral is so solidly grounded that it would be almost an impossibility to clear the grounds from it, are we not wasteful in our methods of interior wiring, as well as getting a final installation at maximum cost and minimum reliability?

For instance: What do we gain by putting high-grade rubber insulation on a wire that is permanently operated grounded, and can be operated in no other way? Why not simply give it a single braid weatherproof covering to prevent corrosive action only and not as electrical insulation in any sense?

Why do we run our common neutral into a building and then split it up into numerous small branches paralleling each other throughout most of their length? Why not



neutral. We need no disconnecting or protecting devices, for the good and simple reason that it neevr needs testing or protecting.

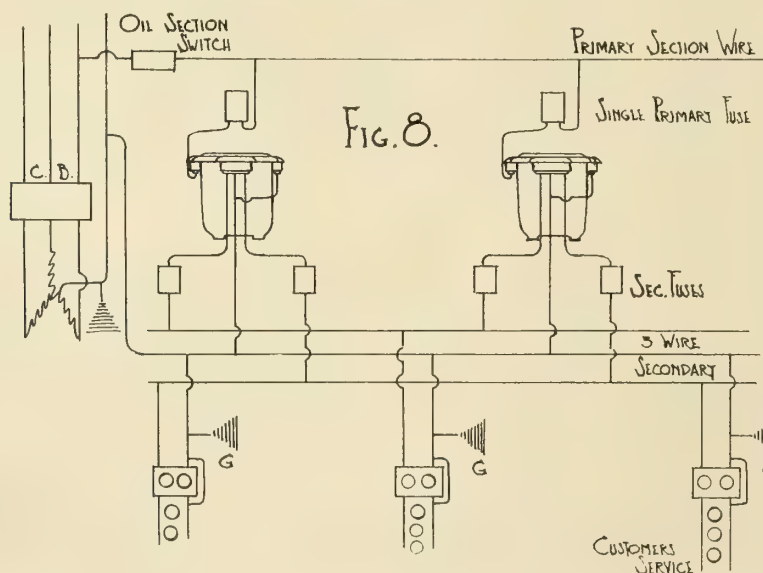
With such a system we can easily cut our installation costs from 15 to 25 per cent. and our maintenance costs by even a greater amount.

As a paper of this kind would hardly be complete without touching on the question of grounding of circuits whose voltage is higher than that of an ordinary secondary distribution system, I will transgress a few moments more on your valuable time in an endeavor to give you a brief outline of my experience and convictions as to these higher voltages.

There are two factors which enter into the grounding question: First, the life hazard; and, second, the reliability of operation, under which also comes the fire hazard.

Taking up the life hazard, this may be considered as applying only to circuits of from 150 volts to 6,600 volts, as above this voltage it is not good practice to attempt to work upon live circuits.

As to what is a fatal voltage is an open question, and

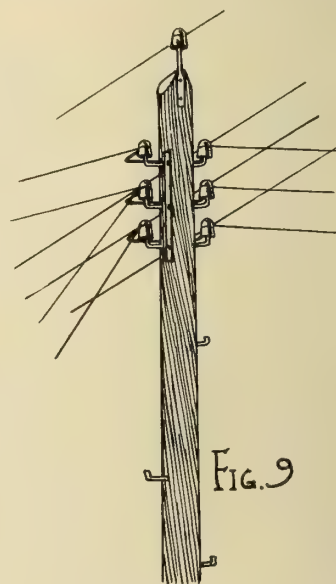


make this a common conductor throughout the installation and not only save wire but save 50 per cent. of our losses in the branch wiring?

Why should we encourage this waste by going even further and protecting each of these split neutrals with a fuse, knowing that the blowing of this fuse is already re-

one which depends entirely upon the condition under which one may make contact with the circuit. Numerous cases are on record where shocks from 110 volts have proven fatal; and, on the other hand, shocks at voltages as high as 60,000 have not proven fatal.

In the writer's opinion the whole question of fatality





depends on surface contact resistance, and the actual voltage is far from being the governing factor. By the use of an ordinary megger I have made resistance tests of the body and have gotten readings of from 4,000 to 40,000 ohms under different conditions of skin moisture, these tests being made with ordinary voltmeter contacts used as electrodes, giving probably one-half square inch surface contact. Under similar conditions I have found that the resistance between two fingers of one hand is practically identical to that between two fingers of opposite hands, showing that the body itself is of very low resistance and that practically all the resistance is in the skin itself. We can make a number of deductions from these tests. For instance: A shock from one hand to the other will paralyse the lungs before it will affect the heart. One from either hand to the head will produce unconsciousness before affecting any other part of the body. From one hand to any point below the heart line, but on same side of the body, will produce muscular contraction of a severe nature without necessarily affecting either the heart or lungs. From one hand to opposite side of the body below the heart line will pass current directly through the heart and produce fatal results in the majority of cases. The tests also show that a fractional part of an ampere will, and has, produced fatal results.

With such a widely varying factor entering into the problem, it becomes impossible to draw any line where we shall or shall not ground. For this reason the writer advocates grounding, and grounding solid all distributing and transmission systems irrespective of the operating voltage. We know that up to 250 volts grounding is desirable. On a large 550 volt 3 phase network, supplied from star connected transformers, the neutral has been grounded for several years with a vast improvement in operating conditions over the former delta connected ungrounded network. In the ungrounded system it was found to be utterly impossible to keep the network free from grounds for any extended period; consequently, it was a selection between getting a probable shock at 550 volts and a certain shock at 330 volts. At the lower voltage condition pressure to ground was fixed and always known, consequently could be easily avoided.

At 2,300 to 4,000 volts I have already shown that ground-

ing has been found to be very desirable from an operating standpoint. As to the life hazard, practical operation with such a system has shown that the fatalities have been at least no greater, and probably less, from the grounded system at the higher voltage than from the old ungrounded delta system. The answer to this is, I think, found in the knowledge of all the men working on such a system that they **must take precautions which they should take** on an ungrounded system which may develop a ground on any wire at any time.

As an illustration of the improved operating conditions obtainable from a common neutral grounded system, this system has passed through a very severe lightning storm with practically no damage or interruption; while a delta connected system with no primary grounds, and covering exactly the same territory, went absolutely out of business and required several days to get back into normal operation.

This common neutral system has from time to time become crossed with every class of circuit adjacent to it, including 600 d.c. trolley and 60,000 volt transmission, and has come through with all flags flying every time.

On the higher transmission voltages, grounding is, to my mind, equally desirable. The strain on insulators is always to ground and not from line to line. True you have two sets of insulation to depend on in an undergrounded system; but, if we are to believe advocates of non-grounding, the advantage of an ungrounded system is the ability to operate with one line grounded. If this is admitted, of what use is our double insulation if we can limit our maximum voltage to ground to 58 per cent. of operating voltage by grounded star connection?

In a recent report in one of our technical journals, covering 54 systems operating at high voltage, it was shown that 56 per cent. of these used star connection either wholly or in part. Of these but 16 per cent. operated ungrounded, and 37 per cent. operated with solid neutral grounds and the balance through resistance ground. This shows that I am not by any means alone in my contention, and it is my belief that every one of these systems could improve their operation by grounding. Of those operating delta connected I further believe every one of them could star their trans-

(Continued on p. 55)

Table 1.—Cost figures on representative menus (See p. 38)

	BREAK-FAST	FOOD	DINNER	FOOD	SUPPER	FOOD
	KW.H.		KW.H.		KW.H.	
Mon. ....	.657	Oatmeal, Dropped Eggs on Toast, Toast, Coffee	1.219	Pork Chops, Fried Apples, Boiled Potatoes, French Toast, Sauce for French Toast, Coffee	1.338	Omelet, Fried Potatoes, Muffins, Tea, Preserves
Tues. ....	.366	Corn Flakes, Fried Eggs, Toast, Coffee	3.085	Roast Beef, Mashed Potatoes, Baked Macaroni, Caramel Pudding	1.030	Creamed Codfish, Pop Overs, Preserves, Tea
Wed. ....	.581	Oatmeal, Meat on Toast, Toast, Coffee	1.348	Soup, Steak Broiled, Steamed Potatoes, Vegetable Salad, Suet Pudding, Coffee	.934	Beef Warmed Up, Boiled Potatoes, Bread, Tea, Cake
Thurs. ....	.948	Corn Flakes, Fried Bacon, Fried Eggs, Muffins, Coffee	1.424	Lamb Chops, Creamed Potatoes, Green Peas, Apple Pie, Coffee	.460	Baked Beans, Toast, Sauce, Tea, Cake
Friday. ....	.713	Oatmeal, Hash, Toast, Coffee	1.071	Tomato Soup, Fried Ham and Eggs, Mashed Potatoes, Turnips, Coffee Jelly, Coffee	1.302	Creamed Beef, Fried Potatoes, Toast, Tea, Layer Cake
Sat. ....	.618	Cornflakes, Fried Smelts, Toast, Coffee	1.393	Boiled Halibut, Egg Sauce, Steamed Potatoes, Stewed Tomatoes, Pie, Coffee	1.192	Scrambled Ham and Eggs, Cranberry Sauce, Biscuits, Tea, Layer Cake
Sun. ....	.610	Pork Chops, French Toast, Coffee	4.019	Roast Turkey, Cranberry Sauce, Potatoes, Onions, Suet Pudding	.741	Cold Roast Turkey, Biscuits, Tea, Cranberry Sauce, Pork Cake
	4.493		13.559		6.997	

Total K.W. Hours for seven days ..... 25.049



# Legal Aspect of Company Interference

By G. H. Montgomery, K. C.\*

While the American Reports are full of cases dealing with this important subject, very little attention has been paid to such Canadian cases as have been decided, and as the subject is one with which an operating man is in daily contact, the writer has felt that a few notes upon such of the Canadian cases as have come under his attention would be of interest to the members of this Association.

In large centres, particularly where telephone companies, telegraph companies, tramways and electric light companies, and frequently competing systems of each, are compelled to occupy the same streets, and more particularly where the greater part of the construction is overhead, conflict is bound to arise, and the Courts have on a number of occasions been called upon to settle the difficulties between the several holders of conflicting franchises. While the guiding principle has been and should be the reconciliation of franchises so as to permit the operation of all and to prevent anything of the nature of exclusive occupation on the part of any one franchise holder, it is obvious that in the majority of cases superior rights must be conceded to one or the other. As a general rule, priority of occupation will give such superior rights, and any company going into a field already occupied by another company operating an electrical franchise will be held to respect the rights of the prior occupant and to so arrange its system as not to interfere with that of the earlier occupant. This principle, however, suffers certain exceptions either by reason of the nature of the franchise or having regard to the reasonableness of the occupation or the system employed by the first occupant. Deiser, in his work "Law of conflicting Uses of Electricity and Electrolysis," has summarized the principles as follows:—

"The street railway is a dominant franchise in city streets. It is a burden upon country highways.

"The construction and operation of the street railway cannot, in normal cases be enjoined by any other franchise holder, merely because the exercise of the franchise is harmful to it.

"Telephone and telegraph companies may procure a certain degree of immunity from disturbance through induction by using the McCluer device or the complete metallic circuit. Such a company therefore can obtain no relief from the courts unless it can show that it is maintaining its plant at a state of efficiency consistent with modern development in electrical apparatus. The Canadian cases suggest a test in this connection that seems final. A company not making use of such appliances is certain to be disturbed sooner or later by some electrical franchise, street railway, electric light or electric power. It cannot hope to exclude forever all other franchises from its territory merely because it fears disturbance when it has voluntarily kept its own apparatus at a low state of efficiency.

"All direct trespasses may be restrained. All wanton trespasses may be restrained. It is probable that the direct injury of apparatus or property by escaping currents of electricity is actionable both in England and the United States.

"The location of wires and other apparatus will al-

most invariably be controlled in such a manner as to harmonize the operation of both franchises."

## Bell Telephone vs. M. S. R.

These principles were applied by the Quebec Courts in the case of The Bell Telephone Company vs. Montreal Street Railway Company, Official Reports 6 Q.B., page 223. There, it was held by the Court of Queen's Bench:

"The dominant purpose of a street being for public passage, any appropriation of it by legislative authority to other objects will be deemed to be in subordination to this use, unless a contrary intent be clearly expressed. So, where the operation of a telephone service worked by the earth circuit system, was interfered with by a street railway company's adoption of electricity as its motive power, it was held that the telephone company having no vested interest in or exclusive right to the use of the ground circuit or earth system as against a street railway company incorporated by statute, the telephones company could not recover by way of damages from the street railway company the cost of converting its earth circuit system to what is known as the McClellan or common return system—a change which was rendered necessary by the street railway company's adoption of electricity as its motive power."

The judgment of Davidson, J. (now Sir Charles Davidson, Chief Justice of the Superior Court), which is confirmed by the Court of Appeals, lays down the following principles, viz.:—

"Considering that the dominant purpose of a street is for public passage, and that the privileges exercised by defendant expedite public travel and promote the public use to which streets are devoted;

"Considering that while plaintiff is permitted to construct telephone lines along the sides of and across or under the public highways, these lines must not interfere with the public right of travelling on or using such highways (43 Vic., Ch. 67, Can. 1880), and that the business of telephoning while working for the public benefit is an object which must be deemed to be in subordination to the dominant right of public travel."

Following the same idea, Sir Alexander Lacoste, Chief Justice of the Court of Appeals, said:—

"The Appellant (The Bell Telephone Company) invokes the priority of its franchises over that of the Respondent. . . . but we should remark that the Appellant by its Charter has only a restricted privilege in the streets. It cannot interfere with the public in the use which it wishes to make of them. The streets are above all for circulation, either on foot or in vehicles, and the establishment of a railway for the carriage of passengers, whatever may be its mode of locomotion, is an ordinary use of the streets. To prevent the establishment of a system of transportation of this nature would be to diminish the rights of the public. Without doubt, a railway should avoid as far as it can reasonably do so causing any damage to the telephone company, but it is for the latter to protect itself and to accommodate its system to the inconveniences which are inevitable."

## Bell Telephone vs. Belleville Electric.

On the other hand, in an earlier Ontario case between the telephone company and an electrical company (Bell Telephone Company vs. Belleville Electric Company, Queen's

\*Read before the Montreal C. E. A. Convention.



Bench Division, 12 Ont. Reports, page 571) the earlier occupation by the telephone company as giving a priority of privilege was maintained. There, the Court said:—

"It appears the plaintiffs were in possession of the ground for the erection of their poles, and that they had their poles erected about two years before the defendants put up their poles. That, however, did not give them the exclusive possession or right to use the sides of the roads on which they had placed their poles, even if they had the independent right to use the sides of the roads under the Dominion Act, without the consent of the municipal council. It is not necessary to say whether the Dominion Act or the Provincial Act is the Act under which the plaintiffs had the right to exercise their powers—that is, whether they have the right to use the road sides for their poles without the leave of the municipality, or only with such leave according to the Ontario Act.

"It is sufficient to say that being in the earlier possession of the ground required for their poles the defendants have not the right to interfere with or do any act to the injury of the plaintiffs' earlier right. The defendants would not have the right to cut down or remove the plaintiffs' poles, nor to make use of them, nor to place wires or do anything else which would damage the purpose or usefulness of the poles or wires which the plaintiffs had placed there; nor to render useless or prejudice the business which the plaintiffs were and are authorized to carry on by means of their poles and wires; nor to cause danger to life or property by stringing their wires so near to those of the plaintiff that life or property is endangered thereby."

#### **C. P. R. vs. Falls Power Co.**

A somewhat similar decision was subsequently rendered in December, 1907, by Mr. Justice Riddell in the High Court of Ontario in injunction proceedings between the Canadian Pacific Railway Company, et al. vs. Falls Power Company. There, the C. P. R. and the Bell Telephone Company had been using the same line of poles in the Town of Welland for the carriage of their telegraph and telephone wires. The Falls Power Company having received permission from the Town by By-law, commenced the erection of a line of poles through the telegraph and telephone lines with the intention of overbuilding the latter and carrying distribution and transmission wires of 2,200 volts and 12,000 volts respectively over the telephone and telegraph wires. In some cases it was proved that the poles actually touched the existing wires. Mr. Justice Riddell found upon the evidence that it would be certain to cause substantial interference not only from the leakage during the wet weather, but by reason of the fact of the linemen being obliged to ascend from time to time through the telephone and telegraph wires. He also found upon the evidence that there was grave danger of the high voltage wires falling upon the telegraph and telephone wires. Upon this finding on the facts he held that the permission granted by the Municipality was not sufficient answer to the complaint made by the telegraph and telephone companies, and that no power exists by which a Municipality under the Ontario statutes can permit one company to interfere prejudicially with the property of other companies. He accordingly granted an injunction restraining the defendant from erecting or maintaining poles for the carriage of wires intended for conducting electricity in a line with and between the poles of the plaintiffs or either of them, and stringing wires thereon over or parallel to the wires of the plaintiffs or either of them, and also directing the defendant company to remove the poles already erected.

#### **Jacques Cartier W. & P. vs. Q. R. L. & P.**

As between competing electric companies, what is known as "the three-foot rule" has been laid down and more or less

consistently followed by the Courts of the Province of Quebec. This rule is first found in that Province in a very elaborate judgment delivered by the Court of King's Bench in the case of the Jacques Cartier Water & Power Company vs. the Quebec Railway, Light & Power Company, Official Reports 11 K.B., page 511. **Held**, reversing the judgment of Andrews, J.

"1. When the Legislative authority gives to two or more companies similar powers to be exercised in the same territory, the Courts must necessarily conclude that the Legislative power in question wishes to give them concurrent powers; in such a case, the Courts being bound to submit to the Legislative power, should not intervene between these several companies except when one of them trespasses upon the acquired rights of the other.

"2. Three feet seems to be, according to the experts or connoisseurs in the matter, a sufficient distance to avoid all immediate danger."

In the Lower Court Mr. Justice Andrews had gone very much further, and after referring the case to experts he had ordered the defendant company, which was the later in occupation, to remove its wires, upon the ground that the suggestions made by the experts for the diminishing of the danger involved such an interference with the property, poles, wires and appliances of the plaintiffs as rendered their suggestions impossible of adoption, and that their adoption would not in all cases protect them from danger and detriment.

His opinion was shared by Mr. Justice Cimon in the Upper Court, who held that the rights of the first Company comprised not only the space occupied by its poles and wires, but also for the purposes and during the existence of its line "all the space upon the earth and in the air reasonably required for the maintenance and exploitation of this line." He also denied the right of the second company to attach the wires of the first company to its posts by means of insulators.

The majority of the Court of Appeals, however, held that it was the duty of the Court to reconcile the two Charters, both having been granted by the Legislature, and in consequence modified the judgment to the extent of obliging the later Company to move all posts and wires which were less than three feet from those of the earlier company. The majority agreed, however, with the opinions of Andrews, J., and Cimon, J., to the effect that they could not oblige the earlier company to attach or allow its wires to be attached to the poles of the later company. This case was decided in 1902.

#### **Montreal L. H. & P. vs. Maisonneuve.**

This "three foot rule" was subsequently followed by Mr. Justice Charbonneau in 1910 in a case between The Montreal Light, Heat & Power Company, the Town of Maisonneuve and the Dominion Light, Heat & Power Company, where the Court on demand for an injunction enjoined the Dominion Light, Heat & Power Company "from placing any poles, wires or other apparatus within a distance of less than three feet from the poles, wires and other apparatus of the company petitioner."

On a subsequent application in the same case made in February, 1911, upon the company petitioner's complaint that the respondent company had violated this order by running its poles through the wires of the first company and overbuilding its lines, the Court held that it was impossible to permit the building of one aerial line over another, without at the same time authorizing one of the two companies to make use of the apparatus of the other company, or without establishing a joint use of the same apparatus, the word "apparatus" evidently being used to mean poles. The Court held that it had not the power to order such a species of



partnership or to create a servitude upon the poles and wires of the other company, and accordingly ordered the removal of the poles and wires complained of.

In a later case decided in the same year by Mr. Justice Davidson between The Montreal Light, Heat & Power Company and the Montreal Electric Company, the Court held that the fact of running poles through the earlier wires or attaching side blocks to the earlier poles constituted such an interference with the petitioning company's rights as to entitle the latter to protection:

"I entirely adopt the remarks made by Andrews, J., in the Jacques Cartier case at page 524. He said that when an electric company is in occupation of streets or portions of streets or public places of a city prior to the advent of another electric company, such prior occupation, while not creating exclusive rights, is entitled to protection and to maintenance so far as such possession is a reasonable one."

The order of the Court ran as follows:—

"Firstly, doth order and enjoin the respondents:

"1. Within one month from the service upon them of the present judgment to remove:—

"(a) all poles which project through the wires of petitioners;

"(b) all wires whether primary or secondary (the latter term including wires from transformers into buildings and wires carrying less than 600 volts) which are within 3 feet of the primary or secondary wires of petitioner's existing system;

"And in default of the respondents complying with the foregoing order, within two months of the service upon them of this judgment, doth authorize the petitioner to cause the same to be removed at the cost and expense of respondents.

"Secondly, the court doth enjoin and restrain the respondents.

"(a) from erecting poles projecting through the wires of petitioners;

"(b) from running wires or transmitting electric currents, whether primary or secondary, at a less distance than three feet from the primary or secondary wires of petitioner's existing system.

"Thirdly. Doth reserve to the respondents the right to apply to the court in respect of any places or localities where the petitioners occupy both sides of the streets when one side would suffice, or where some unimportant change in the position of petitioner's poles or wires would obviate the otherwise complete blocking of the streets, to the end that in such cases the court may order as to law and justice may appertain."

#### **Chambers Electric vs. Town of Truro**

The principal that the occupation of the first Company must be a reasonable one, and that it will not be allowed to act in such a way as to purposely prevent the latter Company from exercising its franchise has recently been followed in the Province of Nova Scotia in the case of the Attorney-General and the Town of Truro vs. Chambers Electric Light & Power Company, 14 D.L.R., page 883. The summary of the holding in this case is as follows:—

"An electric company will be restrained from arbitrarily and unreasonably lowering its wires for the sole purpose of compelling a competitor, which otherwise could string its wires below the first Company's wires and still leave a clear space of three feet, as required by Section 6 of Chap. 130 of Nova Scotia Acts of 1889, and had begun operations accordingly, to re-arrange its entire plant and go above the first company's wires."

The principle which can be gathered from the foregoing cases is that while it is the duty of the Courts to construct and apply the Charters of conflicting companies of equal

authority in such a manner as to harmonize them and permit the exercise of both, that nevertheless the Company which is earlier in occupation is entitled to all reasonable protection and has an acquired right to all the space occupied by its poles and wires to such an extent that a Court is without power to permit a company coming later into the field to make use of the poles and wires of the earlier company even to the extent of attaching side blocks or cross-arms to prevent interference.

Before leaving the question of franchises and charter rights, it may be said that the Courts of the Province of Quebec have held on several occasions that it is quite within the powers of a Municipal Council to grant an exclusive franchise for a fixed term of years. As against this, the Privy Council, held in 1909 that where a Company was incorporated by Provincial Statute with the exclusive right of supplying electricity within a certain radius, that this would not operate against the general powers granted by a Dominion Charter, the holding of the Court being:

"That where a field of legislation is within the competence of both the Dominion Parliament and the Provincial Legislature, and both having legislated, in case of conflict the enactment of the Dominion Parliament must prevail."

The case referred to is that of "La Compagnie Hydraulique de St. Francois vs. The Continental Heat & Light Company, Law Reports, Appeal cases (1909), page 194.

While the principles above given as to the more or less absolute rights acquired by an earlier company were no doubt sound in law they have been considerably modified in practice by the establishment of Public Utilities Commissions in several of the Provinces with wide powers of regulation. In the exercise of these powers such Commissions have in many cases not only permitted but ordered the joint use of poles.

In the Province of Quebec considerable questions have arisen as to how far the establishment of the Public Utilities Commission with powers conferred upon it has interfered with the jurisdiction of the Courts.

#### **Quebec R. L. H. & P. vs. Dorchester Elec.**

In a comparatively recent case of the Quebec Railway Light, Heat & Power Company and the Dorchester Electric Company, Official Reports 23, K.B., page 159, this question came up for the decision of the Court of King's Bench upon an appeal from a judgment of the Supreme Court where it had been held that the jurisdiction of the Courts had been removed. Here, the Quebec Public Utilities Commission had issued a general order respecting electrical conditions in the City of Quebec to the following effects:—

"1. Wires of different companies or persons, whether of the same class or not, shall not approach within three feet of one another, if strung on different poles and running parallel or are crossing. If on the same poles, twenty-two inches will suffice;

"2. At all points of crossings, proper support shall be provided to prevent swinging, or greater distances than those named above shall be observed;

"3. Extra high tension wires must be at a minimum distance of at least five feet from any other wires;

"4. No wires other than low pressure and signalling wires shall be allowed to approach within three feet of any part of any building, unless required to enter the same, and shall be securely fastened and insulated, if attached to any part of such building by supports of any kind."

The plaintiff company applied to the Superior Court for an injunction, claiming that this order had been violated by the defendant. An exception was taken to the jurisdiction of the Court, and this exception was maintained in the

(Concluded on page 53)



# Progress of the "Safety First" Movement

By J. F. H. Wyse, Organizer and Engineer, Ontario Safety League

"The term, "Safety First," is said to have been originated by the United States Government, in a nation-wide movement, during 1908, to reduce accidents in coal and metal mines. It is estimated that there were, during the years 1908-9-10 and 11, on account of this campaign, 51,400 lives saved.

"Safety First" is the slogan under which many Safety Leagues, Safety Committees and Associations of to-day are conducting vigorous campaigns for the prevention of accidents.

The movement is almost universal (at least as far as civilized countries are concerned). Its objects are good—the saving of life and limb.

**HISTORICAL.**—For centuries the ingenuity of man has sought out many inventions to perfect machines for almost every conceivable purpose; however, neglecting the greater care and conservation of the finest machine of all, namely, the human being. To produce the finished article, the laborer, the mechanic, the artisan, the engineer—in fact, all the human element used in factories of every description—had been, up to recently, seriously neglected. The wonderful human machine and its care had been held cheaper than the mere mechanical device.

We have to give the little country of Holland the credit for taking the initiative in accident prevention, in a crusade for human safety and for setting the whole world an example in this laudable work. In the year 1893 a few enthusiasts rented a small dwelling, and secured and placed therein some photographs, models, drawings and actual machines, with devices and attachments, showing their dangers and how to avoid these dangers in operation. At the present time this organization occupies a new and commodious building in Amsterdam, opposite the Rjyks Museum.

Berlin was the next to fall in line, and in 1903 established a Museum of Safety Appliances, which stimulated the public interest. Such success was attained by these museums that the Government soon took them over and looked after their maintenance and enlargement. To-day this Berlin Museum is said to be the finest of its kind in the world.

Shortly afterwards Germany established similar museums in Munich and Dresden, and to-day Germany is said to have solved the great problem of public safety. What Germany has done, we have yet to accomplish.

The American Museum of Safety, with its head office in New York City, established in 1908, is a vigorous child of this Dutch and German parentage. There are now, at the following places, some twenty-two, or more, of these institutes for the promotion of Safety and Hygiene—Amsterdam, Berlin, Barcelona, Brussels, Budapest, Copenhagen, Dresden, Frankfurt-on-the-Main, Gratz, Helsingfors, London, Milan, Moscow, St. Petersburg, Stockholm, Vienna, Wurzburg, Zurich, Paris (two), New York City, and, last but not least, Montreal."

"In the Industrials of Europe it is conservatively estimated that the "Safety First" movement has reduced accidents at least 50 per cent, and the work has been done with the firm belief that "Every life saved is a national asset."

Expenses caused by accident are a burden to the taxpayer, and saving along these lines is a "balance on the right side of the ledger."

Dr. Zacher, Director of the German Imperial Bureau of Statistics, makes the following statement:—"One billion marks (nearly \$250,000,000) is saved in wage-earning efficiency annually in Germany through our sanatoria, museums of safety, convalescent homes and other forms of social insurance, by

which we safeguard the lives and limbs of our workmen, and prevent the cause and effects of disease, which would lessen their economical efficiency. Some of our industrials and manufacturers are waking up to the fact that prevention of accidents pays, and that it is far cheaper and more economical than compensation."

Dr. Tolman, Director of the American Museum of Safety, and author of a volume entitled "Safety," to which I am indebted for much information contained here, says:—"A recent case brought to light the fact of how one manufacturer, after the inspector's report had been received, left a floor pit uncovered. Shortly afterwards a workman fell into it, and received \$15,000 damages. Literally, a wooden hand-rail at the top of this precipice would have cost \$5; the ambulance at the bottom cost \$15,000."

In Germany every employer must belong to the trade association of his business. He pays to this association an accident premium, which is an insurance of his workmen's safety, and he, the German employer, knows, after twenty-five years' experience, that any accident is sure to be thoroughly investigated, and the first question asked will be, "Was there a proper safeguard provided?"

"Many railways and street railways in the United States and Canada have organized a safety movement to conserve, not only the public, but their own employees. The results have been so successful that it is said, 'Once a "Safety First" movement is started, it is never abandoned, but goes on increasing its work and widening its scope.' One of these railroads saved one hundred and seventeen lives and seventy-five hundred injuries in a campaign of some forty months; and a street railway, by letters to automobile owners and teamsters, reduced its street traffic accidents in one month about 40 per cent."

"Based upon accident prevention work in the United States, and what they have accomplished, similar work in Canada would effect a vast economical and social saving.

Money is being freely spent by our Governments on Forests, Game and Fisheries, while our wage-earners, when hurt through avoidable accidents, become a burden upon the taxpayer and objects to charity. Would not some of the public money spent to prevent these accidents be a good investment? Educational and legal prevention of accidents and disease by sanitation is better and more economical than the cost thereof after accidents have occurred. In other words, "An ounce of prevention is worth a pound of compensation."

It becomes more easy to obey rules for safety when their importance and wisdom is realized than if they are to be regarded as mere rules. We must wake up here in Canada, as they have done in some other parts of the world, to the subject of conservation of human life and limb.

There is nothing in the "Safety First" movement of a political or partisan nature. Its aims are to invite all creeds, parties and interests in a universal endeavor to safeguard life and limb. The work is in no sense revolutionary, but proposes to accomplish its objects by sane and conservative methods; to make suggestions, to give warnings, to get the co-operation of all the people all the time, and to secure their moral and financial support as an investment that has paid, and will still continue to pay.

The Ontario Safety League, formed at the suggestion of the Ontario Railway and Municipal Board, is conducting a vigorous campaign against street accidents. It is almost solely educational, and for ways and means is entirely dependent upon public subscription.



# Reflection in Submarine Cables

By L. P. Crim, B.C. Telephone Co., Vancouver, B.C.

The recent laying by the British Columbia Telephone Company of a submarine telephone cable between Point Grey and Nanaimo together with the land connections, makes possible the establishing of a continuous telephone circuit from Vancouver via Nanaimo, Victoria and Bellingham (Wash.), back to Vancouver. This circuit passes through the two principal submarine cables owned by the company and makes an excellent circuit on which to study the effects of reflection at the cable ends.

The cable between Bellingham and Victoria is of the 4-core gutta percha insulated type for use in deep water. The copper conductors weigh 180 pounds each per naut. and are each insulated with 180 pounds of g.p. per naut. There are about 14.7 nauts. of this cable in five pieces varying in length from 0.25 to 8.0 nauts.

The Point Grey-Nanaimo cable is of the continuously loaded type and has stranded copper conductors weighing 300 pounds per naut. which are each insulated with 300 pounds of g.p. per naut. A complete description of this cable is given in the A.I.E.E. Proceedings, Vancouver Branch, September, 1913, pages 1819-1831 inclusive, and an interesting account of the laying operations appeared in the Electrical News previous to that date.

It was found that the reflection losses in the physical circuits of the Bellingham-Victoria cable amounted to about 6 miles of standard cable, while in the phantom circuit, the losses were about nine miles of standard cable. The heavy transmission losses in the phantom circuit have prevented its use prior to this investigation.

In the new Point Grey-Nanaimo cable it was found that reflection losses in the two physical circuits were equal to about 3 miles of standard cable per circuit, with about 5 miles loss in the phantom. It is proposed to work a fourth circuit through cable by means of a grounded phantom on the metallic phantom. Investigation has shown more than 15 miles of

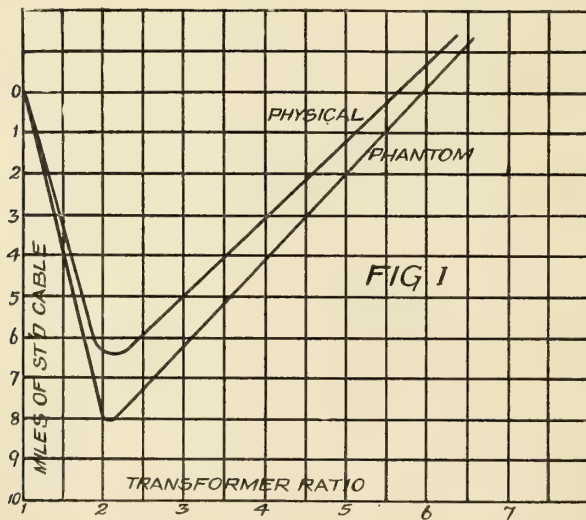


Fig. 1.

standard cable reflection loss in this circuit. This possesses some rather unusual qualities for a telephone circuit. Its loop resistance (total) is about 32 ohms (including terminal transformers), total capacity about 39.6 microfarads, the total inductance about 39.2 millihenrys, with a total leakance of about  $11.20/10^4$  mhos.

Much has been written by the theoretical investigators concerning reflections of waves in passing from one portion of a circuit to another of different surge impedance, but there

seems to be little or no published record of experimental research in this direction. The surge impedance for a telephone circuit may be likened to the diameter of a long speaking tube. If the diameter of a long speaking tube increases suddenly and continues at the larger size for say 200 feet and then is suddenly reduced to a comparatively small diameter again for the rest of its length, it can readily be understood that sound waves passing through the tube will be partially reflected at the square ends where the tube changes size. If these partial reflections exist to any great extent the speaking

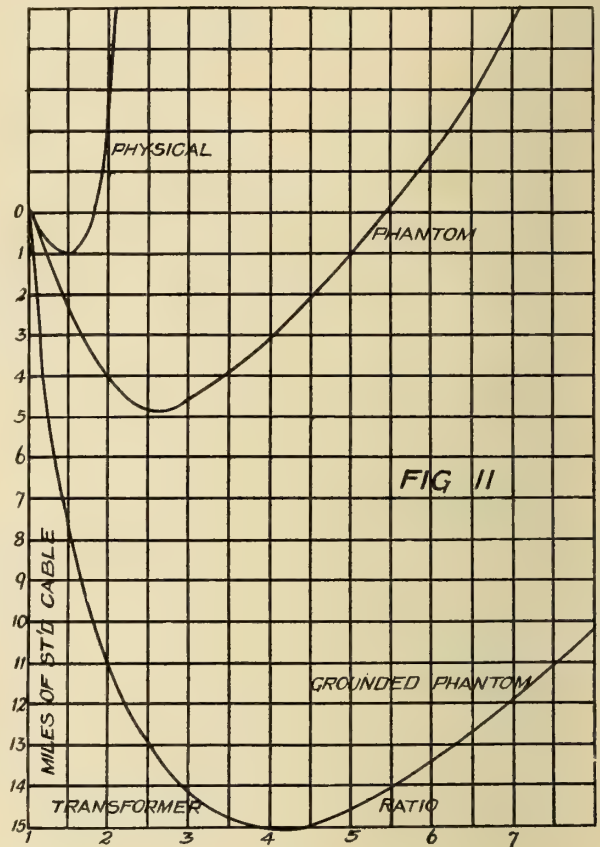


Fig. 2.

qualities of such a tube will not be good. The surge impedance of a telephone circuit is the proportionality factor between voltage and current of the travelling electric waves. As these waves constitute a certain definite quantity of energy, its amount cannot change except by attenuation. Therefore, if the surge impedance of the circuit changes, the proportionality factor between the current and voltage also changes, which is to say that there is a transformation of current and voltage at every point in a circuit where the surge impedance changes. This change in voltage and current sends a reflected wave in the opposite direction to that of the initial wave, the size of which depends upon the sending end impedance of the circuit in either direction from the point of reflection. If these reflected waves are attenuated until they become of negligible size before reaching the receiving end of the circuit, the energy thus reflected becomes lost. As the phenomena of reflection is caused by the transformation of current and voltage due to the change in surge impedance, it is quite logical to assume that this effect may best be overcome by inserting in the line at the junction point a transformer of the proper ratio of transformation. The investigation was therefore conducted along these lines and the attached curves show some of the experimental results obtained.

Fig. 1 shows the variation of transmission equivalent obtained by using transformers of various ratios at the ends of



the Bellingham-Victoria cable. Curves are shown for the physical and phantom circuits.

Fig. 2 shows a similar set of curves for the Point Grey-Nanaimo cable, for the physical, metallic phantom, and grounded phantom circuit.

Fig. 3 shows a set of four curves obtained from the Point Grey-Nanaimo submarine cable, using respectively one, two, three and four cable cores in multiple as one conductor with ground return. The reason for the seeming inconsistency of

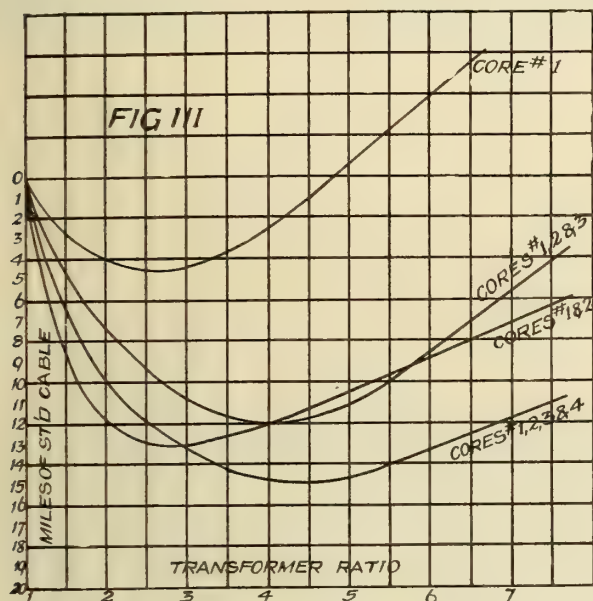


Fig. 3.

the curve obtained from cores 1 and 2, with respect to the other three, is not apparent.

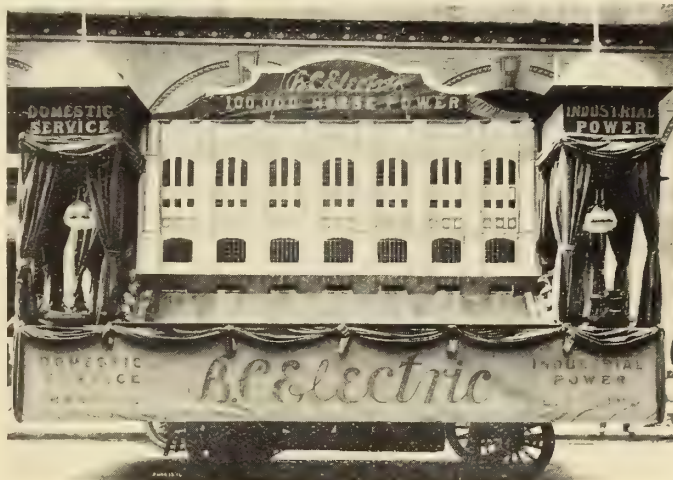
After obtaining experimentally the ratio of transformation that would give the best transmission in each case, a set of transformers was made and installed at the cable ends. It was found that experimental results checked theoretical calculations as to the transformer ratio required, with a fair degree of approximation.

(Note.—The standard cable referred to has the following properties:  $R = 88$  ohms per mile loop,  $C = .054$  mf.,  $L = .001$  henrys,  $S = 5/10^6$  mhos.).

### Vancouver's Pageant

Among the many fine industrial floats and exhibits represented in Vancouver's first Pageant Parade held on June 12th in honor of the Convention of the Pacific Coast Advertising Men's Association and the British Columbia Lumbermen's Concatenation, none were more spectacular or unique in character than the floats provided by the B. C. Electric Railway Co., depicting the progress that has been in the company's transportation and light and power departments since entering this field. The main feature of the company's light and power float, appropriately labelled "The Source and the Service," was a working model of No. 2 Power House situated at Lake Buntzen on the North Arm of Burrard Inlet. This float measured 12 x 20 feet in size and was mounted on an electric truck, the current from the storage battery being utilized to operate a 3 h.p. motor which pumped water from storage tanks and kept it flowing from the tail races of the power house during the parade. At each corner of the float were small towers each of which was occupied by a person with appropriate equipment representing the applications of electric current to industrial power, lighting, heating and domestic service. The entire float was handsomely decor-

ated in the company's colors of green and gold. Another of the company's exhibits and one which aroused a great deal of interest because of its historical associations was the first street car ever operated in Vancouver, having been placed in service in 1889. The growth of the city's tram service since that year was shown by a banner on each side of the float with



B.C.E.R. Company's parade float.

the announcement: "Vancouver's street car fleet, available 1889—two cars, available 1914—231 cars. Seated on the car were motorman A. Elliott and conductor, J. Jeffers, these being the men in their respective positions now holding first rank as to period of service.

### Legal Aspect of Interference (cont. from p. 52)

Lower Court, where it was held that the matter was exclusively within the jurisdiction of the Commission. An appeal was taken to the Court of King's Bench with the result that the decision was reversed by a majority of three to two. The majority of the Court held that the general jurisdiction of the Supreme Court is not taken away by the powers and jurisdiction given to the Commission, except in so far "as public safety and convenience are involved in the complaint or controversy," and that accordingly the plaintiff had a right of action in the Superior Court to restrain the defendant from stringing wires upon or attaching appliances to its poles as well as to have the defendant's wires removed to a distance from the plaintiff's wires sufficient to ensure that the plaintiff's property would not be interfered with.

While the above collection of decisions is not by any means exhaustive of the Canadian cases, except perhaps in so far as the Province of Quebec is concerned, it is the writer's hope that their compilation may be of some assistance to the members of the Association who are called upon to deal with the principles involved, as well as to those whose duty it is to advise them.

### Grounding of Distribution Circuits (cont. from p. 49)

formers, ground their neutral, and with same insulators get equally good or better operation and greatly increased line transmitting capacity.

The whole problem of grounding can be summed up in a nutshell. You can easily and economically insulate any circuit for its normal operating voltage, but you can't insulate for any unknown higher voltage, which may be anything up to the highest voltage anywhere adjacent to it. By solidly grounding any circuit you absolutely protect it against any higher voltage circuit with which it may become crossed and absolutely fix your insulation strain to its normal operating value.



# Illumination

## High Efficiency Lamps

Announcement is made by the Canadian Sunbeam Lamp Company that they are now manufacturing in Toronto, a number of types of high efficiency Mazda lamps. These lamps have a rating of approximately .6 watts per candle and will be manufactured in sizes from 80 candle power up, although at the present stage of development of this lamp the most promising types are the 6.6 amperes, or higher, street series unit, and the multiple type lamps of 750 and 1,000 watts.

The new mazda lamps are made with concentrated filaments. Otherwise they differ from the old mazda lamp in that the bulb is filled with nitrogen gas instead of being a perfect vacuum. The gas contained in the bulb is at approximately atmospheric pressure. Nitrogen is an inert gas so that the filament does not combine chemically with it and the life of the lamp is approximately as long as with the vacuum type.

Increase in efficiency of the incandescent lamp has been limited mainly by the tendency of the filament to volatilize when heated to a very high temperature. This volatilization diminishes both the total life and the useful life of the lamp. The former, because the flying off of minute parts of the filament reduces its diameter and hastens the time when the filament will break at its weakest point; the latter, because the particles of filament that fly off are deposited on the bulb causing the candle-power to fall off considerably during life.

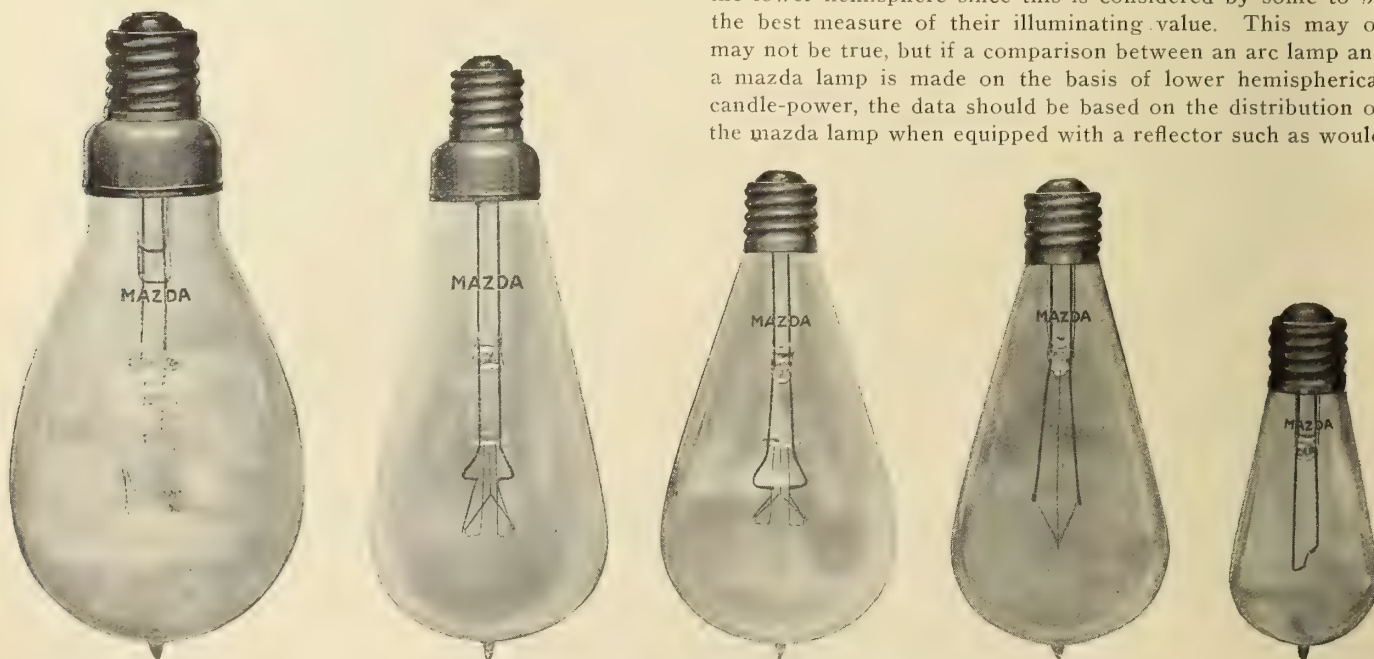
By the use of nitrogen in the bulb this tendency to volatilize is greatly diminished, since all parts of the filament are under atmospheric pressure which greatly raises the temperature of volatilization. This can readily be understood when it is considered that water will boil in a perfect vacuum around 0° Centigrade (freezing point).

At present the new lamps are being made only in high amperages, so that their first appearance on the market is under the street series schedule and under the multiple schedule for lamps of 750 and 1,000 watts. These large multiple lamps have an efficiency of approximately .6 watts per candle. Undoubtedly further developments will make it possible to produce these lamps for lower wattages, especially so in the case of low-volt or compensator lamps.

In operating the lamps it is necessary to exercise great care to insure the current remaining nearly constant, inasmuch as the filament operates at an extremely high temperature and a slight excess of current has a marked effect upon the life.

## What One-Half Watt Per Candle Means

The rating of 0.6 watts per candle for an incandescent lamp would at first glance seem to indicate an efficiency 100 per cent. greater than for a standard lamp at an efficiency of 1.2 watts per candle. It must be remembered however that these efficiency ratings apply to the horizontal candle-power only. In the case of standard mazda lamps, the mean spherical candle-power, which is really the measure of the total light, is only 0.8 of the horizontal candle-power, or in other words the reduction factor is 80 per cent. In the case of the new mazda lamps the reduction factor is between 90 and 100 per cent., depending upon the size of the lamp, as shown by light distribution tests just completed. This means that the total light of the new lamps per watt is not merely double that obtained from the older lamps but is in reality considerably more. The ratings which are frequently given to flaming arc lamps and similar illuminants apply not to the horizontal or hemispherical candle-power but to the mean candle-power in the lower hemisphere since this is considered by some to be the best measure of their illuminating value. This may or may not be true, but if a comparison between an arc lamp and a mazda lamp is made on the basis of lower hemispherical candle-power, the data should be based on the distribution of the mazda lamp when equipped with a reflector such as would



Types of High Efficiency Mazda Lamps—From 100 candle power down.



be used in practice. The present 500-watt mazda lamp at one watt per candle when equipped with the best reflector will give a mean lower hemispherical candle-power of 665 or a hemispherical efficiency of 0.75 watts per candle. Under similar circumstances the new mazda lamp at 0.6 watts per candle would show an efficiency of 0.4 watts per candle. This is far higher than is obtained under working conditions from practically any other form of electric illuminant.

### Lawn Tennis at Night

An interesting application of electric light is found in the lighting of lawn tennis courts so that the game can be played almost as easily by night as by day. It is not to be understood that night play in the open is as satisfactory as under sunlight but nevertheless it has been found more satisfactory than artificially lighted indoor play and can be quite enjoyable when the element of novelty is considered.

A large number of tennis clubs in the United States are now playing at night on artificially illuminated courts, the light coming entirely from the sides, from mazda lamps and large angle reflectors. The Lakewood Tennis Club of Cleveland was the first to adopt the system for their courts and the illustration herewith shows an entire absence of shadows



Playing lawn tennis by electric light.

a perfect screening of the light source from direct vision and a surprising uniformity of illumination.

Twenty-four Wheeler 45 deg. angle reflectors with 250 watt mazda lamps were evenly spaced twelve to a side, and suspended 16 feet above the ground from a messenger cable strung over three posts on each side of the court and well anchored. The high wire netting, stretched around the court to prevent the balls from being knocked out of bounds, also served to protect the lamps and reflectors from stray balls. In later installations as few as six units have been used to a side, but eight are as few as should be used to give adequate illumination without shadows.

The general success of "night tennis" may be judged by the following comment of the American Lawn Tennis Magazine. "That this system, though apparently simple, is decidedly practical, no shadow of doubt should longer exist. The only phase which I would class as a disadvantage is an initial strangeness during a few games or possibly a set. Directly this has been dispelled, as it does become with but few exceptions, the game may proceed at ever so fast a pace and still be free of more than the ordinary run of uncertainty.

Lobs of whatever height or depth are played without trouble. Services are also, after a time, readily followed. Low volleying both "across court" and at "short" range may be executed with sufficient precision. We gave this matter a very good test (in this respect) when we had our

night tournament. We had about fifteen players, representing all the different clubs of the city, play in this tournament, and none of these players had ever been on our courts before, or had ever tried playing at night. There was not a person who had any complaint against it, and, as you will know, if there are any faults in anything, it doesn't take a tennis player very long to state his opinions."

### Lighting Stock Quotation Boards

By J. L. Stair

The first requirement to be met in a special lighting problem of this kind is that of providing even illumination over the entire surface of the board, so that figures and quotations may be as easily seen at the bottom of the board as at the top. Again an intensity of illumination must be provided sufficient to enable the marks on the board to be seen from any part of the room. It is very desirable also to so arrange the lighting system, that no lamps or reflecting equipment are visible, since nothing can be more uncomfortable than to attempt to watch the operations of the stock quotation board, with numerous glaring lamps in plain view.



A well lighted Quotation board.

Ordinarily there is a waste of current in the lighting of quotation boards; more lamps are used than are necessary. This waste can be easily eliminated by using care in the selection and placing of lamps and reflectors. In the installation shown herewith the requirements for good lighting have been admirably met. Note with what distinctness the figures on the board stand out, and how well the bottom of the board is illuminated. The question of concealing the lamps was simplified by the fact that a beamed ceiling was used in the room, it was only necessary to build in an additional or false beam near the board and parallel to it. This beam, which is in reality only an apron, is about 3 ft. from the wall, and drops down in front of the conduit and reflectors which direct the light upon the board. The beam is finished in mahogany to conform with the woodwork and trim, and at the rear of the room is easily mistaken for one of the beams making up the ceiling construction. In this installation the X-Ray scoop reflector was installed, spaced about 2 feet apart, with 60-watt mazda lamps burning in a pendant position.

Mr. Wm. C. Wilson, of The Wilson-Carr Manufacturing Company, 45-7 Elm street, Toronto, manufacturers of lighting fixtures, announces that he has purchased the interest held by his partner, Mr. E. S. Carr, and will, in future carry on the business under the name of The Wilson Brass & Copper Manufacturing Company.



# The Dealer and Contractor

## Writing Electric Specifications

This is the age of specialization. Keen competition necessarily makes it so. It follows that there are few men who can hope to become proficient in more than one line of trade and so, the better class of architect and contractor is coming to recognize that the electrical field is one they cannot hope to cover unless indeed they have attached to their staff a department that specializes on this particular section of construction work.

The electrical specifications of a decade ago were considered to have satisfactorily covered the field if the simple statement was made that an electric light system would be installed, but the last few years have seen many changes in this direction. The requirements of the present day, which demand the greatest possible efficiency in every direction have resulted in the recognition of the value of a thoroughly safe and permanent distribution layout of both light and power. So it has come about that the writing of specifications for an electric plant whether for power or light, or both, has become a branch of the work which can only be properly taken care of by the skilled electrical engineer.

This work of the engineer must now be considered as distinct from the work of the electrical contractor as the architect's work is distinct from that of the building contractor. It is true that many an electrical contractor both designs and installs, just as even yet we have horrible examples of the building contractor who architects his own buildings, but the result is often equally disastrous and with the rapid developments and increased requirements in electrical work threatens to become more generally the case. The exception is the few rare cases where an electrical contracting company are sufficiently strong to include on their staff a skilled designing engineer. Generally speaking, the

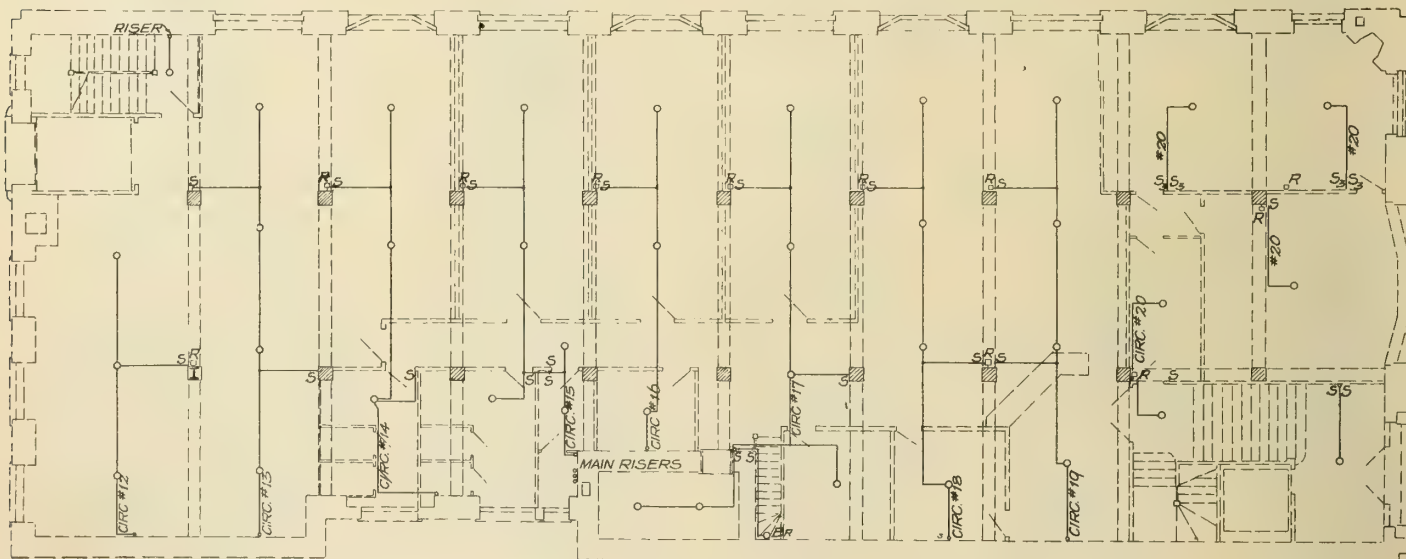
need of specialists to prepare electrical specifications is becoming every day more necessary and, we are pleased to note, more and more apparent.

As an example of what has been accomplished in the way of proper electric specifications by one consulting engineering firm we print herewith a copy of the specifications for a large new seven-storey building in the central section of Toronto. In addition we commend them as a basis for the electrical contractor who is still in the position of having to prepare his own plans and specifications. We print also in connection with this piece of work a plan of the ground floor, which is to be used for office purposes. This floor is typical, however, especially as to the supply of power. We are indebted for these details to the firm of Ewart & Jacob, electrical engineers, Toronto, who specialize in this particular line of work.

## SCOPE OF INSTALLATION

These specifications are intended to cover the supply of all material and labor required for a complete electrical installation in the new building as set forth in the title page. This involves:

- A. Lighting System, 110-220 volts, D.C. or A.C.
  - (1) Service, pipe, box, etc.
  - (2) Main risers, private and public.
  - (3) Complete distribution, basement, ground and second floors.
- B. D.C. Power System, 110-220 volts.
  - (1) Service, pipe, box, etc.
  - (2) Main riser.
  - (3) Elevator feeders.
- C. A.C. Power System, 550 volts, 3 phase, 25 cycle.
  - (1) Service, pipe and box.
  - (2) Main riser.



Ground floor wiring plan of large office and warehouse building.



**Working Conditions**

1. Building is now in course of erection and nearing completion.

2. Building will be practically empty and clear for the work under these specifications, but work will have to be started at once, while some of the building trades are not yet finished.

3. Building is of semi-mill type construction with brick walls, wooden beams, columns and flooring.

**Plans**

Plans Nos. C-24, C-25 and C-26 are the plans for basement, ground floor and second floor respectively. These plans shall be considered as forming an integral part of these specifications.

**DETAIL SPECIFICATIONS****A. Lighting System****(1) Service Pipe, etc.**

1. Install standard service pipe, consisting of 3 No. 00 wires in 2-in. conduit, in rear of building as shown on plan.
2. Terminate pipe in a steel box, 12 in. x 48 in. x 12 in. deep.
3. Install in box one 200 ampere, 250 volt, 3 pole single throw switch, leaving room at top for power company's main fuse blocks. Install also at bottom two 3 pole, 250 volt fuse blocks, 60-100 amp. capacity with 75 ampere fuses. These to feed the two mains described later. Install all connections from main switch to these feeder fuses, leaving a proper meter loop and space for meter.

**(2) Main Risers.**

1. Install feeder of 3 No. 4 wires in 1½-in. conduit from service box to panel boxes PB1 and PB2 on side of vault in basement. This feeder is to supply the proprietor's portion of the premises (basement and ground floor) and is to be connected to one set of fuses above referred to, this set alone being fed through meter.
2. From other set of fuses, connected back of meter, install feeder of 3 No. 2 wires in 2-in. conduit to a

9-in. x 12-in. x 6-in. steel box on side of vault on third floor and install in this box one 3 pole 30-60 amp. fuse block with 50 amp. fuses.

3. From this feeder make tap on second floor of same size to panel PB 3 on front of vault on second floor. Install 24 x 36 meter board at PB3.

4. Continue from fuses in box on third floor with 3 No. 6 wires in 1¼-in. conduit to top (sixth floor) inserting a 9-in. x 12-in. x 6-in. steel outlet box on fourth, fifth and sixth floors. These boxes to be located approximately 5 feet from floor.

**(3) Distribution.**

1. Wiring for lighting, distribution to be installed in basement, ground floor and second floor.
2. Sub-circuits to be taken from panel boards, one for each floor as follows:

PB1: Supplying basement, located basement 3 to 2 wire type, 12 circuit capacity with knife switches and N.E.C. enclosed fuses in branches. Main switch and fuses at base.

PB2: Supplying ground floor, located basement, 3 to 2 wire type, 10 circuit capacity, N.E.C. enclosed fuses but no switches in branches, Main switch and fuses at base.

PB3: Supplying second floor, located second floor. Metering panel of 3 to 2 wire type, 10 circuit capacity and 6 meter loops. Metering device to be of a substantial nature and not dependent on the use of clips on the bus-bars. Branches to be equipped with knife switches and N. E. C. enclosed fuses. Main switch and fuses at base.

All panels to have slate frames and to be mounted in steel boxes of surface type. Boxes to be of sufficient size to leave at least 3-inch ditching on all sides. Panels and panel boxes must be of the best quality and of a make approved by the Engineers. Provide necessary means for metering.

3. From the above panels sub circuits to be installed as indicated on the plans and listed in the following summary. In these tables all items are to be con-

**TABLE I.—LIGHTING CIRCUITS**

PB1—11 circuits:

Circ. No.	Description	No. Wires	Size Wires	Size Cond.	Approx. ft. run	No. Outl.	Total Watts	Side Panel
1	Main	2	14	½	73	6	560	R
2	Main	2	14	½	67	6	600	R
3 & 4	Main to J.B.	4	14	¾	38			
	Tap No. 3	2	14	½	32	4	400	R
	Tap No. 4	2	14	½	70	4	400	R
5 & 6	Rear Stairs, Main to J.B.	4	14	¾	84			
	J.B. to S.S.	7	14	1	12			R
	S.S. to Outlet No. 2	2	14	½	9	1		R
	S.S. to Outlet No. 3	2	14	½	14	1		
	S.S. to Boiler R	2	14	½	38	2		
	J.B. to Outlet No. 1	4	14	¾	5	1	660	
	Outlet No. 1 to S.	2	14	½	10			
	J.B. to J.B.	4	14	¾	12			
	J.B. to outlet No. 4	2	14	½	4	1		
	J.B. to top	2	14	½	65	5		
7	Main	2	14	½	91	6	600	L
8 & 9	Main to J.B.	4	14	¾	62			
	Tap No. 8	2	14	½	45	6	600	L
	Tap No. 9	2	14	½	73	7	700	L
10 & 11	Front Halls—Main to J.B. 1	4	14	¾	80			
	J.B. 1 to J.B. 2	5	14	1	13			L
	J.B. 1 to sw.	2	14	½	9			
	J.B. 2 to sub-base	2	14	½	18	1		L
	J.B. 2 to 2nd fl.	4	14	¾	22	2		
	2nd Fl. to top fl.	2	14	½	72	5	660	
	J.B. 2 to gr. fl.	2	14	½	35	1		
	Extra Tap 2nd Fl.	2	14	½	15	1		
	Ele. ta. 3rd fl.	2	14	½	10	1		

PB2—9 circuits:

12 & 13	Main to J.B.	4	14	¾	43			
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Circ. No.	Description	No. Wires	Size Wires	Size Cond.	Approx. ft. run	No. Outl.	Total Watts	Side Panel
12	Main to 1st outlet	2	14	1/2	32	1		
	1st to 2nd outlet	3	14	3/4	10	1	360	R
	2nd out. to sw. R.	3	14	3/4	16	1		
	2nd out. to 3rd out.	2	14	1/2	10	1		
13	Main to 1st outlet	2	14	1/2	7	1		
	1st outlet to 2nd out.	3	14	3/4	11	1		
	tap to sw.	2	14	1/2	13		400	F
	2nd out. to 3rd out.	2	14	1/2	11	1		
	3rd out. to 4th out.	3	14	3/4	11	1		
	Tap to sw.	2	14	1/2	15			
14	Main to 1st out.	2	14	1/2	42	1		
	Tap to sw.	2	14	1/2	15		320	R
	1st to 2nd out.	2	14	1/2	16	1		
	2nd out. to 3rd	3	14	3/4	12	1		
	Tap to Sw. and R.	3	14	3/4	14	1		
15	Main to 1st out.	2	14	1/2	26	1		
	1st to 2nd out.	3	14	3/4	6	1		
	tap to Sws.	4	14	3/4	12		420	R
	Sws. to 3rd and 4th out.	2	14	1/2	27	2		
	4th to 5th out.	3	14	3/4	12	1		
	Tap to Sw. and R.	3	14	3/4	14	1		
16	Main to 2nd out.	2	14	1/2	40	2		
	2nd to 3rd out.	3	14	3/4	12	1	320	R
	Tap to Sw. and R.	3	14	3/4	14	1		
17	Main to sw.	2	14	1/2	30			
	sw. to ceiling	3	14	3/4	8			
	tap to vault	2	14	1/2	14	2		
	tap sw. to Br.	2	14	1/2	20	1		
	ceiling to 3rd out.	2	14	1/2	45	3	540	L
	3rd out. to 4th out.	3	14	3/4	12	3		
	tap to Sw. and R.	3	14	3/4	14	1		
18	Main to sw.	2	14	1/2	56			
	Sw. to 1st out.	3	14	3/4	13	1		
	1st to 2nd out.	2	14	1/2	13	1		
	tap to Sw. and R.	3	14	3/4	14	1	480	L
	2nd to 3rd out.	2	14	1/2	11	1		
	3rd to 4th out.	3	14	3/4	11	1		
	Tap to Sw. and R.	3	14	3/4	14	1		
19 & 20	Main to J.B.	4	14	3/4	63			
19	Main to 1st out.	2	14	1/2	5	1		
	1st to 2nd out.	3	14	3/4	12	1		
	tap to sw.	2	14	1/2	14			
	2nd out. to 3rd out.	2	14	1/2	11	1	460	L
	3rd to 4th out.	3	14	3/4	11	1		
	Tap to Sw. and R.	3	14	3/4	14	1		
20	Main to B.B.R.	2	14	1/2	22	1		
	Tap to Sw.	2	14	1/2	9			
	B.B.R. to out.	2	14	1/2	22	1		
	B.B.R. to sw. box	2	14	1/2	26		630	L
	Sw. box to out.	2	14	1/2	18	1		
	Sw. box to B.B.R.	7	14	1	19	1		
	Tap to B.B.R. Sw. and out.	2	14	1/2	25	2		
	B.B.R. to sw. box	6	14	1	10			
	Sw. box to out.	2	14	1/2	18	1		
PB3-10 circuits:								
21 & 22	Main to J.B.	4	14	3/4	44			
	Tap No. 21	2	14	1/2	36	3	300	R
	Tap No. 22	2	14	1/2	36	4	400	R
23	Main	2	14	1/2	71	4	400	R
24	Main	2	14	1/2	51	4	400	R
25	Main	2	14	1/2	52	4	360	R
26	Main	2	14	1/2	63	4	400	L
27 & 28	Main to J.B.	4	14	3/4	47			
	Tap No. 27	2	14	1/2	40	4	400	L
	Tap No. 28	2	14	1/2	52	4	400	L
29 & 30	Main to J.B.	4	14	3/4	88			
	Tap No. 29	2	14	1/2	27	3	300	L
	Tap No. 30	2	14	1/2	39	3	300	L

sidered as strictly specified with the exception of the column marked "Approximate feet run." These quantities are given for convenience only and are not guaranteed.

### B. D.C. Power System

#### (1) Service Pipe, etc.

1. Install standard service pipe consisting of 3 No. 0000 wires in 2 1/2-in. conduit at rear of building, as indicated on the plans.

2. Terminate service pipe in steel box 24-in. x 48-in. x 12-in. deep.
3. Install in box one 300 ampere, 250-volt, 3-pole, single throw knife switch leaving room above for power company's main cut outs. Install also 3, 100-200 amp., 250-volt, fuse blocks with 125 amp. fuses. These are to supply main riser and be connected direct to main switch.
4. Install also one double pole, 250-volt, 30-60 amp. fuse block with 50 amp. fuses and one double pole 60-100 amp. fuse block with 75 amp. fuses. These are to



supply freight and passenger elevators respectively and be connected up to main switch leaving proper meter loop and space for meter.

(2) Main Riser.

Install feeder from the above service box to side of vault and up to top floor. Same to consist of 3 No. 0 wires in 2-in. conduit. Steel boxes 9-in. x 12-in. to be inserted in riser on 3rd, 4th and 5th and 6th Floors.

(3) Elevator Feeders.

1. Install feeder for passenger elevator from 75 amp. fuses in service box to sub-basement under front entrance. Feeder to consist of 2 No. 4 wires in 1¼-in. conduit. Install at end of this feeder one 250-volt 100 amp. double pole, single throw fused knife switch in a suitable steel box. Same to be located within 10 feet of elevator motor.

2. Install feeder from 50 amp. fuses in service box to freight elevator pent house as indicated on plan. Feeder to consist of 2 No. 6 wires in 1-in. conduit. Install at end of feeder one 250 volt 60 amp. double pole single throw fused knife switch in a suitable steel box, same to be located within 10 feet of elevator motor.

### C. A.C. Power System

(1) 1. Install standard service pipes at rear of building as shown on plans. Same to consist of 3 No. 6 wires in 1¼-in. conduit.

2. Terminate service pipe in a 600-volt 30-60 amp. 3-pole service switch box. D. & W. No. 1818 or equivalent. Same to be equipped with proper outlet hoods and located immediately above Lighting and D.C. Power service boxes above referred to. This box to be equipped with 50 amp. fuses.

(2) Main Riser.

From service box run feeder consisting of 3 No. 6 wires, in 1¼-in. conduit to side of vault and up to top floor, Insert 12-in. x 15-in. x 6-in. steel boxes on 3rd, 4th, 5th and 6th floors.

The following summary of services, risers and power-feeders is appended for additional conveniences, the figures given under "approx. feet run" not being guaranteed.

### Conduit Work

1. All conduits must be secured directly to ceilings or walls, without the use of hangers.

2. All conduits must be run rectangularly, i.e., parallel with or at right angles to building lines.

3. All feeder conduits must pass directly through beams, the necessary holes being bored for the purpose. Sub-circuit conduits may be passed through beams by boring or looped under as deemed preferable. In case conduits are looped under, turns must be made by means of L condulets.

### Wires

1. All sub-circuit wires to be No. 14 B. & S. gauge. Feeder wires to be of sizes indicated in the foregoing.
2. All wires of No. 6 gauge or over to be stranded.
3. All wires to be New Code standard.

### Fittings

1. Outlet Boxes. All ceiling outlet boxes to be 4-in. x 2¼-in. round or octagonal Bossert or equivalent.
2. Wall Receptacles. All wall receptacles to consist of Type G or Type H condulets with porcelain receptacles, with the exception of private offices where flush type receptacles are to be used wherever conduit can be concealed in partition.
3. Switch Outlets and Switches. Switches to be of the rotary snap type of approved make and mounted on Type G or Type H condulets. In private offices wherever conduit can be concealed in partition push button switches are to be used. This applies particularly to 3-way switches in front corner office, and switches in main entrance hall. Wherever a switch outlet and wall receptacle occur together, a Type G and a Type H condulet shall be mounted in tandem, the receptacle being immediately below the switch.
4. Condulets, etc. All taps to switches or wall receptacles must be made with T condulets, boxes not being permitted. Dividing points of two circuits run in a common conduit and marked J.B. on the plans, may be made with T condulets or Junction boxes, as preferred. In the latter case box must be the same as standard outlet box employed.

### General Conditions

1. The "General Conditions" attached herewith shall be considered as forming an integral part of these specifications.
2. All materials and workmanship shall conform to the requirements of The Canadian Fire Underwriters' Association and their certificate furnished at the completion of the work.

### General Conditions

1. These General Conditions shall be considered as forming an integral part of any specifications to which they may be attached and shall be absolutely binding in carrying out any contract awarded in accordance with such specifications.
2. The following interpretations shall be taken of terms used throughout the specifications.

**The Proprietor** means the party or parties who own the building or properties in which the contract is to be fulfilled.

**The Contractor** means the party or parties to whom any contract may be let on the basis of these specifications.

**The Architect** means the architect or firm of architects

TABLE II.—SERVICES AND RISERS

System	Description	No. Wires	Size Wires	Size Cond.	Approx. ft. run	
Light	Stand pipe	3	00	2	20	
	Private Main	3	4	1½	66	
	Public Main to 3rd Fl.	3	2	2	91	Ending at PB1 and PB2. To 9 x 12 box on 3rd Fl. with 3-30-60-amp. fus. block and 50- amp. fus.
	Tap to PB3	3	2	2	14	
	3rd Fl. to top	3	6	1¼	29	9 x 12 boxes on 4th, 5th and 6th floors.
D.C. Power	Stand Pipe	3	0000	2½	20	
	Main and Riser	3	0	2	120	9 x 12 boxes on 3rd, 4th, 5th and 6th floors.
D.C. Feeders	To Pass. Ele.	2	4	1¼	140	To 250 v. 100 amp., 2 PST fused sw. in iron box.
	Freight Ele.	2	6	1	80	To 250 v. 60 amp. 2 PST fused sw. in iron box.
A.C. Power	Main and Riser	3	6	1¼	120	12 x 15 boxes on 3rd, 4th, 5th and 6th floors.



under whose charge the building work is being carried on and who is exercising supervision over any or all trades which may be doing their work at the same time as the work called for under these specifications.

**The Engineers** mean the engineers who have drawn up these specifications and under whose supervision any contract awarded on the basis of such specifications must be carried out.

3. The Contractor (unless otherwise specified) shall provide all materials, workmanship, plant, scaffolding, carriage, freightage and every other matter that may be required for the proper performance and completion of the work and the whole of which are to be the best of their several kinds.
4. The plans accompanying these specifications shall be considered an integral part of the same. Specifications and accompanying plans are intended to co-operate, so that any work shown on the plans and not mentioned in these specifications, or vice versa, is to be executed the same as if set forth by the plans and mentioned in these specifications.
5. Should any drawings or figures be omitted in the plans and details which are necessary to a clear comprehensive understanding, or should any error appear in either plans or specifications, it shall be the duty of the Contractor to notify the Engineers in writing of such omission or error before submitting tender, and in no case proceed in uncertainty with the work.
6. If in the opinion of the Contractor a change of plans or specifications should be made for the proper completion of the work, and if such change alters in any way the original amount of the tender, the Contractor must notify the Engineers and submit price in writing for approval before starting the work. Otherwise, the Engineers will not recognize any change in plans or specifications and no claim for extra payment will be allowed.
7. The plans accompanying these specifications are made as accurate as possible, but absolute accuracy of dimensions cannot be guaranteed. No claim for extra payment on account of difference of actual and estimated dimensions shall be allowed, unless such difference arises through alteration of building plans by the Architect, or unless such difference shall be greater in amount than ten per centum in each case. On all plans figured dimensions are to be taken in preference to measurement by scale and drawings on a large scale are to be taken in preference to those on a small scale.
8. On all plans the correct size, location and nature of all walls, partitions or obstructions of any kind are indicated as accurately as possible. If any additional obstacles are encountered, the Contractor must make good all work through or around such obstacles the same as if they had been originally indicated, and no extra claim shall be allowed on account of such obstacles.
9. The Contractor shall at his own cost make good any defects, settlements, shrinkages, burnouts, grounds or other faults in his work, arising from defective or improper materials, which may appear within twelve months after the completion of the contract.
10. The Engineers reserve the right to reject any and all materials which, in their opinion, are unsuitable for the proper completion of the work, or not in accordance with these specifications, or accompanying plans. Such rejected materials must be removed from the premises forthwith and if used after such rejection the Contractor shall at his own cost tear

down such materials and replace same with approved materials.

11. Successful Contractor shall be required to sign the specifications and accompanying plans as well as revised contract form in which shall be stated manner of payment, time limit, amount of tender, etc.
12. The Proprietor reserves the right to accept or reject any or all bids presented in determining to whom said contract will be awarded. The tenderer's reputation, as well as the amount of his proposal, will be considered and the contract made in accordance therewith.
13. The Contractor will notify the Engineers in writing when his contract is complete. This dated letter will be necessary to obtain his final certificate, which will be issued within thirty days after notification, if the Engineers, on inspecting the work, consider the same complete.

#### Tallman Brass & Metal Company

The Tallman Brass & Metal Company, who commenced manufacturing electrical fixtures in Hamilton less than a year ago have evidently met with excellent success as they announce that they will shortly add a large addition to their factory, amounting to some 22,000 square feet of floor space. This company has had a lengthy experience in the brass business and under a competent organization they have been able to give their customers fixtures both in original designs and of a superior quality and finish. In addition, a very thorough inspection system has been established both during manufacture and in connection with the shipping department, so that customers may be assured of satisfaction in their shipments. Indeed, the fact that this company find it necessary to work overtime during a dull season and to extend their floor space, speaks well for the quality of the goods and service being turned out. Canadian customers are apparently appreciating the fact that work of this sort is being turned out in a Canadian factory, where in addition to the most skilled workmen, a number of designers are employed who will submit special drawings, on application, to meet the particular wishes of the individual purchaser. The Tallman Company are now distributing a very handsome fixture catalogue.

#### Safety First

The following double acrostic written by Mr. R. W. Ennis, Assistant Master Mechanic of the Toronto & York Radial Railway, suggests an entertaining method of giving more publicity, by poster or dodger, to this important movement.

#### SAFETY FIRST

Safety first, last and always  
 Am I my brother's keeper? Yes, and it is  
 First duty to protect him, my employer and myself  
 Ever being on the alert, watching for trouble  
 To eliminate carelessness in any capacity and assist  
 Young and old to reach their goal in safety

First stop, look and listen, be sure yourself  
 Illuminate and guard dark spots and places  
 show and be shown, be from Missouri  
 Remember, accidents are sometimes the result  
 of carelessness, so consider  
 Study the relations of rules and regulations  
 To the ever present and worthy subject

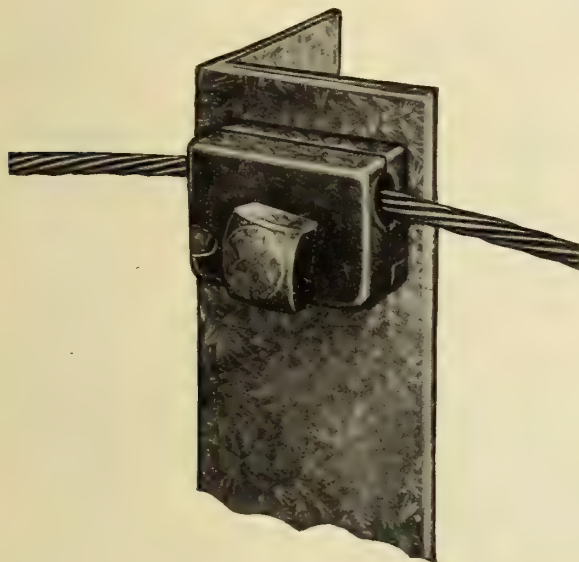
#### SAFETY FIRST

The Canada Wire & Cable Company, Limited, are increasing their capital from \$500,000 to \$3,000,000.



### Ground Wire Clamps

A new ground wire clamp, greatly improved in design, has been placed on the market by the Electric Service Supplies Company. It consists of two identical malleable iron castings, which when fitted together form a clamping jaw to receive either  $\frac{1}{4}$  or 5-16-inch strand. A  $\frac{5}{8}$ -inch bolt of any practical length is placed through these castings so allowing this clamp to be rigidly secured to either bayonets or other ground wire supports used in high tension transmission line construction. These clamps may also be secured directly to wooden or iron poles by means of a through bolt when angle iron supports are not used. A worthy feature of this clamp is that they require but one bolt and are so designed that they may first be secured to the bayonet or pole and the ground wire to be supported placed therein afterwards. Greater wear is insured that part



New type of clamp.

of the ground wire inside the clamp on account of the corrugated surface and the flares at either end of the hole. It will be seen that greater protection is given the strand due to the actual clamping surface being but  $\frac{3}{4}$ -inch, the full width of the clamp being  $2\frac{1}{4}$  inches, therefore allowing a flare at each end of  $\frac{3}{4}$ -inch. Type B clamps differ from the standard type formerly described in that the clamping surface is not corrugated; the whole clamping surface being smooth but with flaring ends. These ground wire clamps are furnished complete with bolts, nuts and lock washers. All parts are heavily galvanized to effectually withstand the action of rust.

### An Interesting Exhibit.

The Canadian Laco-Phillips Company had an interesting exhibit of nitrogen-filled lamps in rooms 310-11 Ritz Carlton during the C. E. A. Convention. Sizes from 250 watts to 1,000 watts were shown. In this later type of Laco lamps the design has been improved by the insertion of a sheet of mica in the upper portion of the lamp which is claimed to maintain the leading-in wires at a considerably lower temperature.

### New Companies

The Excelsior Electric Manufacturing Company, Limited, has been incorporated with capital \$40,000, and head office, Toronto.

The Canadian Hart Accumulator Company, Limited, has been incorporated with capital £60,000, and head office St. Johns, Que.

### Personal

Mr. R. A. Sara sales manager of the Winnipeg Light and Power Department received the degree of Electrical Engineer at the recent University of Toronto Convocation.

Mr. C. L. Howse, formerly of the Hamilton Hydro-electric Department has been appointed manager of the hydro-electric and waterworks system of Peterboro, Ont.

Mr. S. L. B. Lines, general manager the Chamberlain and Hookham Meter Company of Canada, was married on June 27 to Miss Ethel Moore Lamping, of Ridley Park, Pennsylvania.

Mr. J. J. Ashworth, assistant general manager of the Canadian General Electric Company was married on June 16, to Miss Alyce Cooke, of Montreal. Included among the wedding gifts was a cabinet of silver from the president and directors of the company and a silver tea service from the district managers.

### Trade Publications

**Electric Hoist**—Bulletin 301A issued by Pawling & Harnischfeger Company, Milwaukee, describing and illustrating the application of the electric hoist.

**Lamp Guards**—Folder issued by the Electric Service Supplies Company illustrating and describing the Keystone lamp guards, portable and stationary types.

**Truss Pins**—Catalogue issued by the Electric Service Supplies Company illustrating and describing Keystone truss pins and other transmission specialties.

**Steel Taped Cable**—Catalogue issued by The Simplex Wire & Cable Company, illustrating and describing at considerable length, the Simplex Steel Taped Cable.

**Travelling Cranes**—Bulletin issued by the Herbert Morris Crane & Hoist Company, Limited, describing and illustrating the Morris hand overhead travelling crane, type G.

**Bell Ringing Transformers**—Small folder issued by Canadian General Electric is describing Wayne bell ring transformers for which this company are Canadian agents.

**Panels**—Bulletins No. 34 and 35 issued by the Canadian Krantz Electric & Manufacturing Company describing and illustrating respectively the Krantz safety panel and the Krantz straight line panel.

**Travelling Cranes**—Folder issued by the Canadian General Electric Company describing a Sprague travelling crane employed in the shops of the Ford Motor Company, Detroit, for carrying heavy loads.

**Wheeler Reflectors**—Supplement issued by the Canadian General Electric Company describing, with illustrations, Wheeler angle reflectors for lighting tennis courts, ball grounds, bathing beaches and other outdoor recreation grounds.

**Transformers**—Bulletin 105 issued by the Wagner Electric Manufacturing Company, St. Louis, illustrating and describing central station transformers. Some interesting information is given regarding the theoretical construction of this apparatus.

**Railway Signals**—The General Railway Signal Company are distributing additions to their catalogue Section A, Part 6, on Table and Wall Lever Stands; also addition to catalogue Section B, Part 3, on Mechanically Operated Train Order Signals.

**Wiring Devices**—Catalogue 22 issued by Pass & Seymour, Inc., describing their handy electrical wiring devices. A special feature of this catalogue, in addition to very profuse illustrations, is a reproduction of some 25 different color finishes. This will be found of great assistance by the prospective purchaser.



# Current News and Notes

## Belcarres, Sask.

Mr. J. Dawsey, of Melville, is erecting an up-to-date hotel at this place and is installing an electric light plant to light this hotel and a portion of the town. A telephone will be installed in every room.

## Calgary, Alta.

Commissioner Graves estimates that the Municipal Electric Railway System will have a considerable deficit during the present year which may amount to as much as \$50,000. General trade depression in Calgary, in addition to a large increase in interest charges as the result of heavy extension work carried out the last year, are given as the main causes. It is understood, too, that Calgary pays about the highest, if not the highest, wages of any Canadian city.

## Chilliwack, B.C.

Contract has been closed with the British Columbia Electric Railway Company for ten years, under which they supply the town of Chilliwack with 100 watt tungsten lamps installed on brackets. These are for street lighting purposes and replace the old 32-candle power carbon lamps.

## Camrose, Alta.

The town of Camrose has placed an order with the Hill Tripp Pump Company for a six-inch centrifugal deep well pump to be driven by a 20 h.p. motor direct connected. This pump will be working at 105 feet from the ground level and will replace an air lift pump which has been in operation for the past four years.

## Calgary, Alta.

A by-law was recently passed authorizing the expenditure of \$300,000 on electric light extensions.

## Dartmouth, N.S.

Tenders are received to July 2 by the Department of Railways and Canals for a branch telegraph line in the neighborhood of Dartmouth.

## Edmonton, Alta.

The 178 white way lights which the city is now installing will be ready for operation by the first of August, 1914.

The Alberta Government will soon proceed with the erection of a modern long distance telephone exchange in the southeast part of the city.

The Dominion Government having voted the necessary money to build a telegraph line from Lake Saskatoon, Alberta, to Fort St. John, B.C. A gang of men will soon be on its way to construct this line, with Mr. G. Wilder at the head of it. The work will occupy about five months.

The Wabamun Power and Coal Company of this city are preparing plans and estimates for the construction of a power plant to be located at their mine forty miles west of Edmonton. They now have two of their engineers visiting Pacific Coast cities to gather information. The original capacity will be 10,000 kw. and will furnish power to the city and to towns and villages within a radius of 100 miles of Edmonton.

Reports so far go to show that the increase in the Edmonton Street Railway fare to a straight 5c fare is increasing receipts without causing any noticeable falling off in traffic.

## Hamilton, Ont.

Invitations have been sent out for a celebration on July 1st, in connection with the turning on of the new street lighting system.

## London, Ont.

The London Street Railway Company are making a new bond issue to the extent of a quarter of a million dollars.

## Lacombe, Alta.

The town of Lacombe is in the market for a small turbine of 60 kw. capacity to connect to one of their spare generators.

## Lethbridge, Alta.

By-laws will be submitted on July 3 authorizing the expenditure of some half million dollars for various kinds of municipal work. About \$25,000 will be used on extensions to the railway system.

## Moncton, N.B.

A special committee has been appointed, including City Engineer Edington and City Electrician Cochrane, to consider the matter of installing a better street lighting system. It has not yet been decided what type of lamp or standard will be used, but it is probable, judging by present indications, that a municipal generating plant will be established.

## Montreal, Que.

The plans and specifications of conduits on Craig, McGill, Notre Dame and St. James Streets, Montreal, have been approved by the Quebec Public Utilities Commission, and tenders for the work have been called for July 10.

Many of the proprietors and tenants on St. Catherine Street, Montreal, have failed to comply with the order of the Electric Service Commission to connect with the underground conduits, thus delaying the removals of the poles. The Board of Control have given instructions to the attorney to compel compliance with the order.

The Eugene F. Phillips Electric Works, Limited, Montreal, have received the following orders:—for the City of Westmount, twenty miles of single, twin, and three conductor paper insulated, lead covered cable, and four miles of twin and six conductor paper insulated, lead covered cable; for the Montreal Light, Heat and Power Company, fifteen miles of paper insulated, lead covered cable, to be used on the St. Catherine Street conduit; for the Ontario Hydro-electric Power Commission (Windsor), five miles of paper insulated, lead covered, double steel tape armoured cable; for Yorkton, Sask., a similar order; for the city of Calgary, one mile of paper insulated, lead covered cable.

## Outremont, Que.

A contract has been awarded to the Northern Electric Company for 20,000 feet of cable.

## Owen Sound, Ont.

Contracts have been awarded for the construction of two dams in connection with the hydro-electric developments at present under way at Eugenia Falls by the Hydro-electric Power Commission of Ontario.

## Regina, Sask.

The operation returns of the municipal street railway,



S I E M E N S

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

# SIEMENS

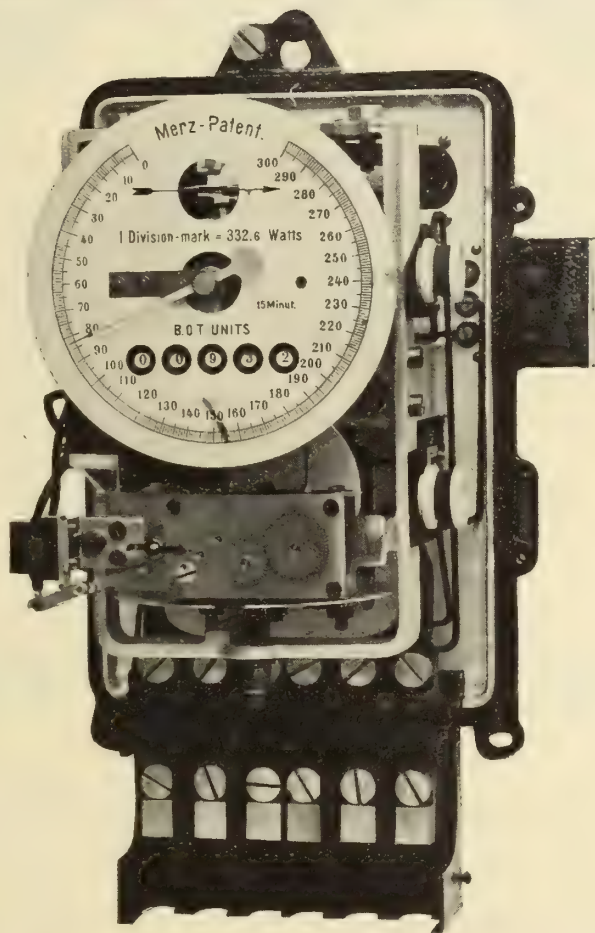
SIEMENS - SCHUCKERT | SIEMENS & HALSKE

S I E M E N S

## What the Meter Does

1. Gives the kilowatt hours.
2. The highest load demanded in watts on a time average of say 15, 30 or 60 minutes.

The accurate measurement of these two quantities enables a true load factor system of charging to be adopted.



## What can be Done With the Meter

1. Charge an annual sum per K. W. or Horse power year to cover capital and standing costs.
2. Charge a low straight rate per K.W. hour based on running costs and profit required.

## These Meters are Approved by the Board of Inland Revenue

Siemens combined integrating and maximum demand meters.

We have in STOCK three phase meters suitable for 110 volts and 550 volts for 25 and 60 cycle circuits, also meters for use with instrument transformers for large capacities.

# Siemens Company of Canada Limited

HEAD OFFICE:  
Transportation Building - MONTREAL

BRANCH OFFICES:  
STANDARD BANK BUILDING  
TORONTO

McARTHUR BUILDING  
WINNIPEG



Regina, for the week ending June 13th are as follows: Revenue, \$3,695.30; passengers carried 86,258; passengers carried including transfers 98,149. For work ending June 20 corresponding figures are,—\$3,986.90, 94,945 and 107,749.

The Hope Telephone Company, Limited, Abernethy, Sask., has been incorporated with capital \$900.

South Welwyn Telephone Company, Limited, has been incorporated with head office Welwyn, Sask., and capital \$1,500.

#### **Sherbrooke, Que.**

The Gas and Electric Department have been authorized to engage a consulting engineer to act jointly with the City Engineer, Mr. Tremblay, in the construction of a concrete dam at the city's municipal electric plant on the Magog River.

The Gas and Electric Department have made a request to Council for a meter appropriation of \$16,000 for the purchase of two thousand electric meters.

The Sherbrooke City Council have decided on a conduit and street lighting system for the main streets, and estimates of the cost of the former are being made by the electric committee. For experimental purposes, the committee will purchase six or twelve standards for the street lighting. An appropriation of \$16,000 has been made for 2,000 electric meters. A consulting engineer will be engaged to prepare plans and specifications, in conjunction with the city engineer, for the construction of an additional dam at the city's electric plant on the Magog River.

#### **Saskatoon, Sask.**

The increase in the Provincial telephone and telegraph lines in the last ten years is from 1,509 miles in 1903 to 16,585 miles in 1913.

The financial report for the first three months of 1914 as presented to council at the recent meeting, shows that the Public Utilities, with the exception of the street railway system, are making fair profits. During this same period the street railway deficit amounts to over \$14,000, which more than offsets the profits of the light and power departments. At the present time, however, conditions are improving, and the month of June is expected to show a loss not greater than \$1,000.

#### **Sudbury, Ont.**

Grading started on May 30th on the route of the Sudbury-Copper Cliff Suburban Electric Railway Company which runs parallel with the Copper Cliff Road. Two miles of grading are completed to date. The total length of this Copper Cliff road is 5.1 miles. Further proposed extensions include the Ramsay Lake road, 1.2 miles, and the Frood Mine road of 2 miles, making a total of 8.3 miles. The Warren Bitulithic Company will put in the concrete bed and paving for the railway and the company will lay their own track. It is not yet definitely determined which motive power will be used but gas-electric is contemplated. Mr. C. D. Norton, Sudbury, is engineer in charge of this work.

#### **St. John, N.B.**

The St. John Railway Company have received two new steel cars from the Ottawa Car Company.

#### **St. Catharines**

Mr. J. S. Campbell, Chairman of the St. Catharines Civic Hydro-electric Commission recently presented to Council an estimate on an ornamental street lighting system covering a number of streets in St. Catharines. Mr. Campbell's report was in part as follows:

"In accordance with the wish of the members of the council attending the joint meeting of the Committee on

Works, the Fire and Light Committee, and this Commission, held on the evening of June 11th, we beg to submit to you an estimate of an ornamental underground lighting system, covering the streets mentioned in the statement published on the 27th of May last.

"The estimated cost of 105 single light standards with 1,000 candle-power lamps spaced on St. Paul street, Queen and James streets, approximately as shown on attached print, is \$11,304.

"The estimated cost of operating these lights is \$4,915 per year, or an annual cost per standard of \$46.81. Deducting from this cost the annual cost of the ordinary street lighting system, the net annual cost per standard, which we understand you desire to charge against the property on the frontage basis as a local improvement, is \$42.80 per year. These lamps, being spaced approximately 100 feet apart on both sides of the street and staggered so as to put one light every 50 feet of the length of each street, would give an approximate cost per foot frontage of 43c per year.

"The estimated cost of 61 single light standards with 100 watt lamps spaced on Church and Ontario streets, approximately as shown on attached print, is \$6,093.

"The estimated cost of operating these standards is \$1,393, or an annual cost per standard of \$22.84. Deducting from these costs the cost of the ordinary street lighting, the total annual cost is reduced to \$926.40. The net cost per standard to be borne by the owners of the frontage on the local improvement basis would be \$15.19 per standard per year. These lamps being spaced approximately 200 feet apart on both sides of these streets and staggered so as to place one light every 100 feet the length of the street, would give an approximate cost per foot frontage of 7.6c per year.

"On Ontario street, from St. Paul to King street, there has been some question as to the type of standard to be chosen; whether the high candle-power used in the business districts or the residential type, the latter possibly spaced at half the distance of the spacing in the residential districts. With the cost per standard given above your decision can be made and the resultant cost readily determined."

#### **Toronto, Ont.**

Works Commissioner Harris has prepared a report dealing with the probable revenue on the Municipal Electric Railway System by an interchange of traffic with the Toronto Street Railway Company. The proposal was for an interchange fare of 5c, and the report finds only a municipal saving of \$6,000.

The matter of rate reduction which the local commission asked the city council to pass upon has been handed back to the commission with power to do as they think best.

The city council have passed a by-law authorizing the official notification of the Toronto & York Radial Railway Company that the city will take over that portion of the line between the C. P. R. tracks and Farnham Avenue at the expiration of the franchise, next year.

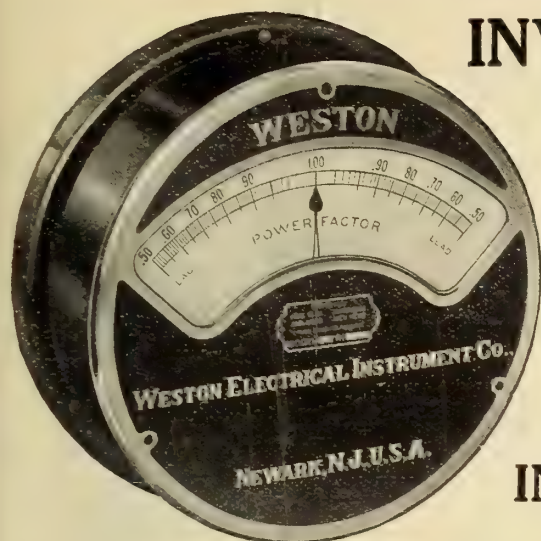
#### **Westville, N.S.**

The city is negotiating with the New Glasgow Electric Company, through Mr. Flaherty, for a flat rate contract. The company offers a rate of \$11 per lamp per annum. This service has been on meter up to the present time.

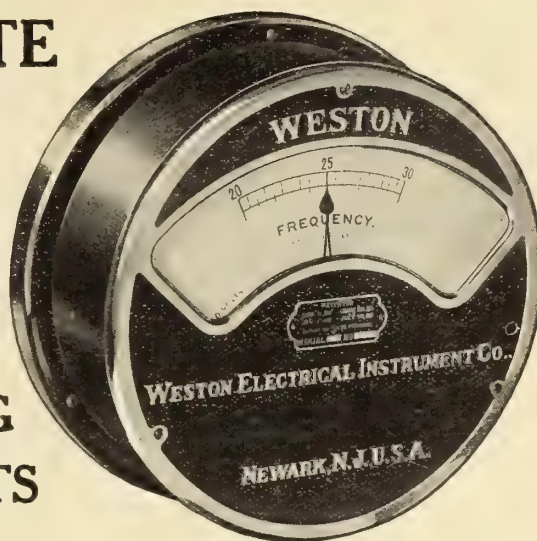
#### **Winnipeg, Man.**

The Winnipeg Omnibus Company has been granted a five-year franchise for the operation of motor busses on the streets of Winnipeg, and have deposited a cheque for \$5,000 as a guarantee of good faith. If satisfactory agreements can be reached with the city council, it is promised that operations will be started immediately.





## INVESTIGATE WESTON A. C. SWITCH- BOARD INDICATING INSTRUMENTS



We invite full inquiry into the merits of **Weston Power Factor Meters** and **Frequency Meters** and also **Wattmeters, Synchrosopes, Ammeters and Voltmeters** for Switchboard service on alternating current circuits. Send for catalogs and advise us the kind of instruments in which you are interested, whether for alternating or direct current service.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

**WESTON ELECTRICAL INSTRUMENT COMPANY, Main Office and Works, NEWARK, N.J.**

Mr. Stanley Brown, 114 Liberty St., New York City.  
Badt-Westburg Elec. Co., 832 Monadnock Block, Chicago, Ill.  
Mr. F. E. Gilbert, 303-4 Hale Bldg., 1326 Chestnut St., Philadelphia, Pa.  
Mr. Geo. H. Moseman, 176 Federal St., Boston, Mass.

Mr. Milton Mill, 915 Olive St., St. Louis, Mo.  
B. K. Sweeney Electrical Co., 2910 Huron St., Denver, Colo.  
Mr. Frank E. Smith, 682 Mission St., San Francisco, Cal.  
Mr. S. C. Dinsmore, 1933 Dime Bank Bldg., Detroit, Mich.  
Walter P. Ambos Company, 1729

East 12th St., Cleveland, Ohio.  
A. H. Winter Joyner, Ltd., No. 76 Bay St., Toronto, Canada.  
Weston Instrument Co., Ltd., Geneststrasse 5, Schoneberg, Berlin, Germany.  
Mr. D. R. Petest, 415 Fourth Natl. Bank Bldg., Atlanta, Ga.  
Mr. Edwin Wortham, Suite 28

Allison Building, 8th St. and Main St., Richmond, Va.  
Montreal  
Winnipeg  
Vancouver  
Calgary  
Western Electric Instrument Co., Audrey House, Ely Place, Holborn, London, E.C.

*Northern Electric Company LIMITED*



# Power Cables

Manufactured by

**British Insulated & Helsby Cables, Limited**

**PAID-UP CAPITAL, \$8,500,000.00**

**HEAD OFFICE—PRESCOT, ENG. Works at PRESCOT, HELSBY and LIVERPOOL**

Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and double steel tape armored cable for a working pressure of 660 volts. This cable is for laying direct in the ground without any protection whatever and is similar to that supplied to the cities of Saskatoon, Prince Albert, etc., etc.

**WRITE FOR ILLUSTRATED CATALOGUE**

**SOLE CANADIAN REPRESENTATIVES :**

**Canadian British Insulated Co.**  
LIMITED  
MONTREAL, QUE.



# Condensed Department

## Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

## FOR SALE

One 115 k.w., 2300 volt, 60 cycle, 3 phase, Allis-Chalmers, Bullock Alternating Generator with exciter, switchboard and instruments complete. Machinery in use three years. For further particulars apply to Chapleau Electric Light & Power Co., Chapleau. t.f.

## Situations Vacant

## Wanted

Live manufacturer's agent to handle entire line of a large electrical manufacturer of power house specialties, on a commission basis. Address, with full particulars to Box 34, Electrical News, Toronto. 12-13

## Superintendent Wanted

Superintendent for large electrical contracting work. In replying state age, experience, general qualifications and salary wanted. Reply by mail only to Keiths Limited, 297 Campbell Ave., Toronto. 12-13

## Situation Wanted

Electrical operator desires change; five years' experience in A.C. and D.C. plants, steam and hydro; young, unmarried. Apply Box 400, Electrical News, Montreal. 12-13

## Electrical Engineer

Electrical Engineer, experienced in the Design and Installation of Transmission and Distribution Systems, seeks engagement.

Seven years superintendent of Construction for large firm of cable manufacturers, in charge of installing underground conduit and cable systems. Best of references. At present employed. Box 39, Electrical News, Toronto. 12

## Electrical Engineer

Position Wanted—Electrical Engineer, Associate A. I. E. E., age 33. Thirteen years' practical experience with D.C. and A.C. machinery, Accumulators, Line erection and maintenance, High speed steam engines and water power plants. At present in charge of Suction gas plant. Box 11, Electrical News, Toronto. 9-13

## Business Opportunity

Eastern Manufacturers or Supply Houses wishing Manager for Western Branch would do well to apply to undersigned Technical Engineer with ten years' experience in Constructing, Estimating, Selling, and Managing. Engineer, Box 486, Winnipeg. 12-13-14

## SECOND HAND ELECTRICAL MACHINERY

Bought, sold, rented, and exchanged. We have the largest stock in America. Send for our monthly bargain sheet showing complete stock with our prices.

**GREGORY**  
**ELECTRIC CO.**  
CHICAGO, ILLINOIS  
Established 1893

## Electrical Machinery

Motors, Dynamos, Generators,  
Electrical Pumps and Supplies.  
Electrical Contractors.  
Motor Repairs.

**MAC**  
**ELECTRIC**  
**CO.**

52 Queen Street - OTTAWA

## Lighting Schedule for July, 1914

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
July 1	10 40	July 2	3 50	5 10
2	11 10	3	3 50	4 40
3	11 50	4	3 50	4 00
5	0 30	5	3 50	3 20
6	1 30	6	3 50	2 20
7	No Light	7	No Light	
8	8 00	8	10 20	2 20
9	8 00	9	10 50	2 50
10	8 00	10	11 10	3 10
11	8 00	11	11 30	3 30
12	8 00	12	11 50	3 50
13	8 00	14	0 10	4 10
14	8 00	15	0 30	4 30
15	8 00	16	0 50	4 50
16	8 00	17	1 20	5 20
17	8 00	18	1 50	5 50
18	8 00	19	2 30	6 30
19	8 00	20	3 20	7 20
20	8 00	21	4 00	8 00
21	7 50	22	4 00	8 10
22	7 50	23	4 00	8 10
23	7 50	24	4 00	8 10
24	7 50	25	4 10	8 20
25	7 50	26	4 10	8 20
26	7 50	27	4 10	8 20
27	7 50	28	4 10	8 20
28	7 50	29	4 10	8 20
29	7 50	30	4 10	8 20
30	7 50	31	4 10	8 20
31	10 30	Aug. 1	4 10	5 40

Total Hours .....170.10



## We Have a Bell For Every Purpose

There can be only one best and that is the Schwarze. No. 12 Common Magneto Extension for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire is all active. Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and very much louder, and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof.

Write for catalogue.

All resistances.

**Schwarze Electric Co., Adrian, Michigan**  
Norton Telephone Co., Canadian Agents





# SWITCH BOXES

We Manufacture  
The Highest Grade Boxes on the Market

## SERVICE

We guarantee prompt shipment  
Standard sizes carried in stock  
Special sizes made up immediately  
Our prices are right

# John T. Wilson Limited

Toronto

- - -

Ontario

Sales Representatives Wanted



Electric



## Flashlights—Batteries—Lamps

Every live dealer should handle them.

Practical and useful, a necessity.

Made in various styles and sizes.

All flashlights absolutely guaranteed.

*Ask for catalogue.*

**Interstate Electric Novelty Co.**  
of Canada, Limited

220 King Street W., - Toronto, Ont.





# Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

**Contract Record**  
and Engineering Review  
Toronto Ontario

## THE NEW ALKLUM ACCUMULATOR

### Special Advantages:

NO LEAD. NO ACID. NO CELLULOID CASE

#### Strength:

Cannot be hurt with overcharging or running down to Zero.

#### Size:

Smaller than any other Accumulator.

#### Life:

Ten times the life of Lead Accumulators.

#### Reliability:

The Voltage keeps practically the same all the time used.

#### Weight:

The Lightest in the World.

#### Convenience:

Having very wide charging rates.

Far in advance of any other Accumulator for Hand-lamps, because it can be left for any length of time without deteriorating. Absolutely the Best for Miners' Lamps, because it gives off the same amount of current the whole of the time it is in use, maintaining the light evenly throughout the day. Most satisfactory for Electric Self-starters. A great advantage over any other Accumulator for lighting cars.

Fully Descriptive Catalogue sent on application to the Makers

**WORSNOP AND CO., LTD.**

LAMP WORKS, HALIFAX, ENGLAND.

Who are also the largest makers of Electric Motor Lamps in the World.

**GUARANTEED TO BE SUPERIOR TO ANY  
OTHER ACCUMULATOR IN THE WORLD.**

We did not originate the phrase

**"Safety First"**

Our slogan is

**"Safety all the Time"**

and an

**I-T-E Circuit Breaker**

provides it

**The Cutter Company**

Circuit Breaker Engineers and Manufacturers

**Philadelphia**



## Flexible Tubing Clamps

Do away with nails, staples, tape and other make shift methods of holding flexible tubing



Type A

These clamps prevent any displacement of the tubing after the job has been inspected.

**Type a**—For combination gas and electric outlets. The center opening for the gas pipe, the outside opening for tubing.

**Type B**—For straight electric outlets. For fastening directly to the Header Board or joist.

**Flexible Tubing Clamps** are quickly and easily installed and should be back of the plaster line. They have round edges to prevent cutting the tubing when bent at an angle with the clamp.

Approved by the National Board of Underwriters.

Write for prices and samples.



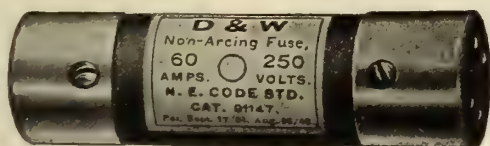
Type B

**New Process Specialty Co., Inc.**  
Milwaukee - Wisconsin

## When Perfection in Anything is Claimed

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**WE HAVE ALWAYS CLAIMED PERFECTION IN "D & W" FUSES**



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## Simplex Lamp-Socket Specialties

meet the requirements of the Dealer and the Central Station man because they are good sellers and give long and satisfactory service.



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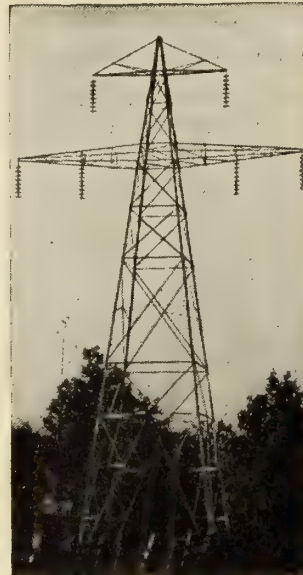
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Building ready for occupancy July 15th.

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Hot Galvanized or Painted

Estimates furnished on application

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MANUFACTURERS OF

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One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario. Transmitting a 110,000 volt current from NIAGARA FALLS to the principal cities of ONTARIO. The largest single order of Transmission Towers ever placed.

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**Structural Steel of all kinds**

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## 16 Distinct Types

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## Panel Boards

with which innumerable combinations can be made

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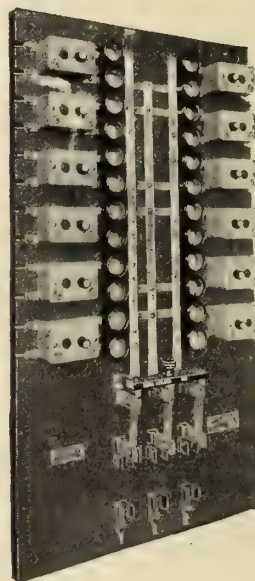
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It means in Locust Pins, Braces, Bolts, Washers, Pole Steps, Etc., all meet A.T. & T. specifications, and in Arms: Washington Fir—at least 85 per cent. heart.

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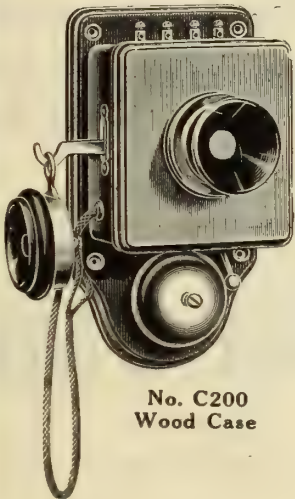
All guaranteed. We stock nothing regularly of a quality inferior to the above.

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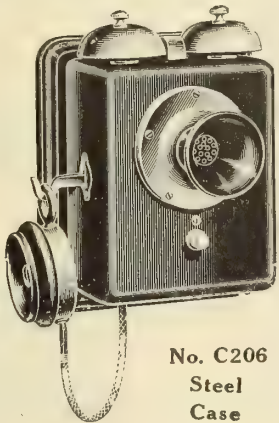
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No. C200  
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**Cheap  
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Induction  
Coils  
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Weight 6½ lbs.

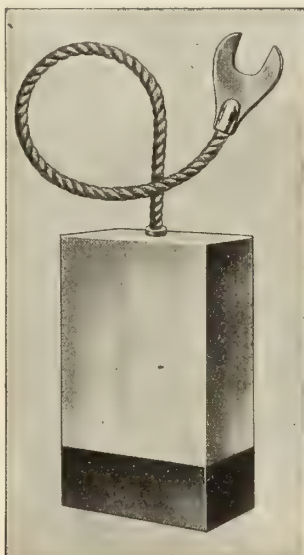
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Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

*Prompt Shipments from Canadian Factory.*

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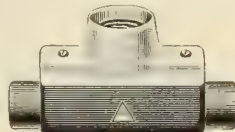
are drawn from steel and possess many merits which are an absolute necessity for up-to-date conduit work. For durability, neatness, space for making wire connections, "Unilets" meet all requirements. "UNILETS" are mechanically right. The conduit is steel, why not the fitting? Try them on your next job. A copy of our new catalogue should be before you. You cannot afford to be without it. Write us at once for your copy.



Cat. No. 9001—Rectangular Unilet.



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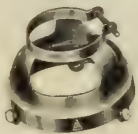
Type No. 2—Rectangular Unilet. Cat. No. 9002 with No. 7650 Receptacle.



Type No. 1 Octagon Unilet. Cat. No. 7501.



Type No. 4—Round Unilet with enclosed Snap Switch.



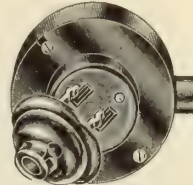
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Cat. No. 6906 Vapor-Proof Unilet.



Combination Plug Receptacle and Push Button Switch Unilet—Hubbell Plug Receptacle and Arrow E Push Button Switch Attached.



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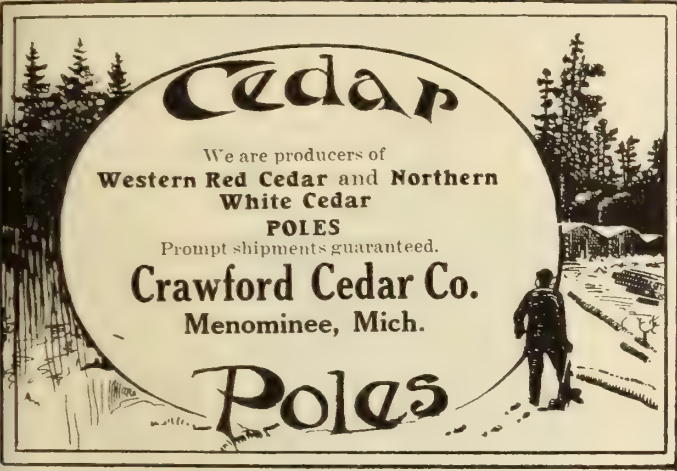
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We are producers of  
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**POLES**

Prompt shipments guaranteed.

**Crawford Cedar Co.**

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# Poles

## Our British Columbia Cedar Poles

will meet your most exacting requirements.  
You'll find them straight, strong, sound-  
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you.

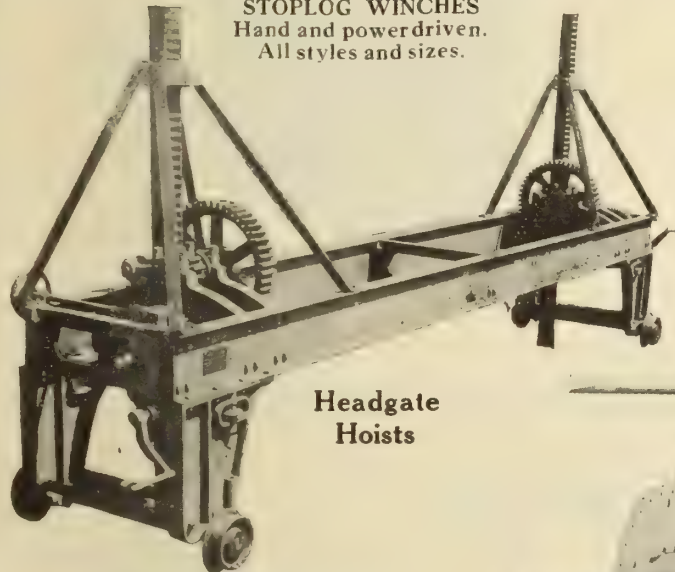
**The Lindsley Brothers Company**

"Good Poles Quick"

Spokane — Chicago

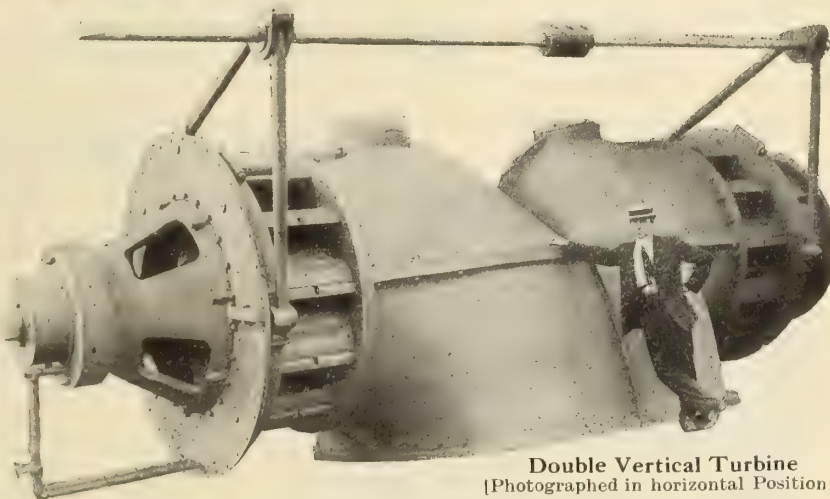
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Hand and power driven.  
All styles and sizes.



Headgate  
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**Machine Cut Gears**  
Extra large stock patterns for  
Heavy Bevel Gears  
having wood and iron teeth.  
Heavy Pulleys and  
Bearings, etc.



Double Vertical Turbine  
[Photographed in horizontal Position]

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Steel Castings  
Propeller Wheels

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**7 CEDAR POLE YARDS IN B. C.—7**

For prices on B. C. Cedar Poles address

**WESTERN LUMBER & POLE COMPANY**

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We have yards in  
Canada guarantee-  
ing our motto:  
"SERVICE"  
"PRICE" "QUALITY"  
ONE QUALITY  
ANY QUANTITY

# POLES





Perfect balance is found in the design of

## Westinghouse Type S Distributing Transformers

**T**YPE S Transformers possess every characteristic desired in a distributing transformer. They have superior insulation, high efficiency, low exciting current, strong mechanical construction, long life, low depreciation, minimum maintenance expense.

The unequalled service record of more than 90,000 Westinghouse Type S transformers installed during the past few years, is the proof of excellence.

**Canadian Westinghouse Co., Limited, Hamilton, Ontario**

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## TIME MEANS MONEY WHEN WAITING FOR REPAIRS



That is why we maintain a corps of expert and competent repairmen, ready to serve you at a moment's notice, day or night.

No matter how small or how large the job, we can give you guaranteed service.

*Our Motto—Promptness and Efficiency*

*Give us a trial.*

During the day call  
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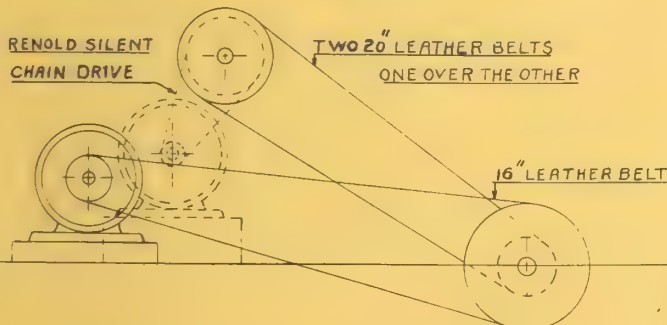
Nights, Sundays and Holidays  
call Beach 1723 or 1930

**Toronto**

162 Adelaide Street West

**Ontario**

## Hans Renold Patent Liner Silent Chain “The Power-Saving Transmission”



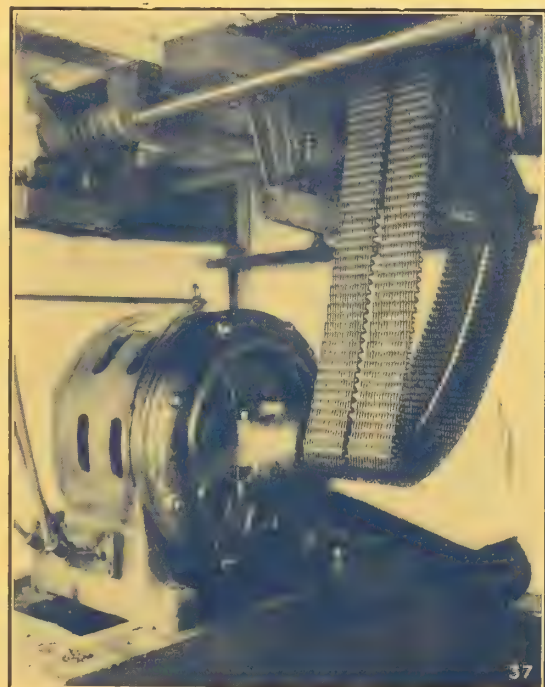
100 HP DOUBLE REDUCTION BELT DRIVE REPLACED BY

RENOLD SILENT GEAR (SHOWN DOTTED IN.)

(43)

Intending users of Hydro-Electric Power **MUST LOOK** to the means of power Transmission. Otherwise tremendous losses will follow. The above cuts show a double reduction belt drive—with which the input to Motor was 125 h.p.—and the chain drive which substitutes it. With the chain drive the load on the lineshaft was increased and the input to the Motor reduced to 95 h.p. or 31 per cent. This saving at \$15.00 per h.p. per year amounts to \$450.00 regardless of increased production, saving of space, etc.

**Have You Any Such Losses?**



The Renold Chain Drive as shown in drawing opposite

**JONES & GLASSCO, Engineers,**  
(Reg'd.)

Sole Canadian  
Agents

**MONTREAL**

Branch Office: **TORONTO**

*We stock Chain and Repairs*



# ELECTRIC REPAIRS

We can keep you running  
while we make your repairs

**FRED THOMSON Co., LIMITED**  
326-328-330 WEST CRAIG STREET  
MONTREAL



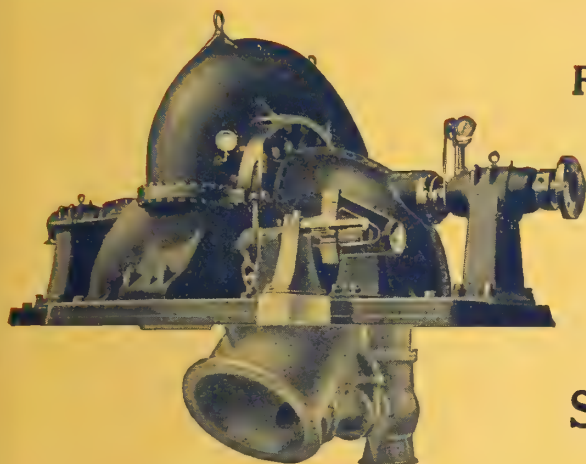
The advertisement features a central circular logo with the text "G & W ELECTRIC SPECIALTIES". Surrounding the logo are ten different types of cable terminal components, including various sizes of pot heads and specialized connectors. A central text box contains the following information:

**YOUR CABLE TERMINAL REQUIREMENTS**  
ARE MET AT EVERY POINT BY THE COMPLETE LINE OF  
**G & W POT HEADS**  
YOU HAVE NO CABLE TERMINAL NEED THAT IS NOT FULFILLED EXACTLY  
BY THE G & W LINE OF SPECIALTIES  
**G & W ELECTRIC SPECIALTY COMPANY, CHICAGO, U. S. A.**  
WRITE FOR NEW CATALOG No. 8



# Electrical News

Generation, Transmission and Application of Electricity



5250 Horse Power 275 Feet Head

## 90 % EFFICIENCY From SMITH HYDRAULIC TURBINES

Recent tests at Holyoke, Mass. of Smith Turbines have again proven their superiority over any turbine now manufactured.

These tests showing efficiencies from 89% to over 90%.

We design and build turbines for heads from 5 feet to 650 feet.

*Send for Bulletin N*

**S. Morgan Smith Co., York, Pa.**

Branch Offices: 176 Federal St., BOSTON, MASS.  
614 American Trust Bldg., CHICAGO



The ever increasing demand from Canadian Central Station Operators, Machinery Manufacturers, etc., is indicative of their appreciation of the keep-a-running ability of

*Century*

## SINGLE PHASE MOTORS

High starting torque, low starting current, small speed slip, quiet operation, interchangeable voltage connections and evenly balanced operating characteristics are some other reasons for their universal popularity.

**CENTURY ELECTRIC COMPANY**

19th, Olive to Pine Sts., ST. LOUIS, MO.

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# UNDERGROUND CABLES

LOW AND HIGH TENSION

FOR LIGHTING,  
POWER,  
STREET-  
RAILWAYS,  
TELEPHONE,  
TELEGRAPH.



ARMOURED  
CABLES FOR  
STREET  
LIGHTING,  
PAPER  
INSULATED  
CABLES OF ALL  
DESCRIPTIONS,  
RUBBER INSULA-  
TED CABLES &c

Also Bare and Weatherproof Wires and Cables,  
Magnet Wire, Flexible Cords, &c.

Galvanized Iron Wire and Strand

HEAD OFFICE:

**MONTREAL, CANADA**

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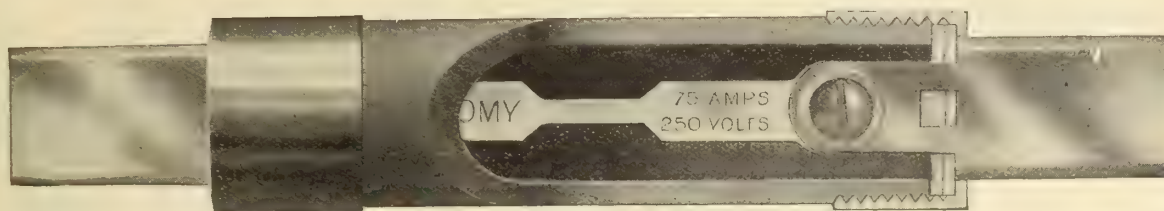
**Toronto,**

**Winnipeg,**

**Halifax,**

**Vancouver.**



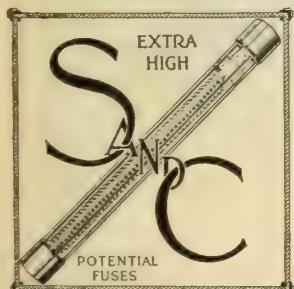


"Look for the Gray Shell"

# ECONOMY RENEWABLE CARTRIDGE FUSES

save money wherever electrical circuits must be protected. One great industrial plant in the States has favored us with orders amounting to \$15,925.01;—their repeat orders prove that ECONOMY FUSES save money and provide proper protection.

The actual saving in annual fuse maintenance expense when ECONOMY renewable cartridge FUSES supersede old-style non-refillable fuses, often amounts to eighty per cent. This is the reason that the use of ECONOMY FUSES is fast becoming standard practice wherever electricity furnishes light and power.



## "S & C" Extra High Potential Fuses

With the addition of this well known line of Dominion made goods, we can now serve your requirements promptly with protective fuses for any voltage from 1 to 150,000 volts, in any commercial amperage. "S & C" Fuses are for use on lines of over 2,500 volts; rapid and positive in action, they clear the circuit and limit the rush of current to a minimum.

*Write for full information, prices and discounts.*

## Economy Fuse & Mfg. Co. of Canada, Limited

Unity Building, Montreal

ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association



Although you naturally associate  
the name

**PEEBLES**

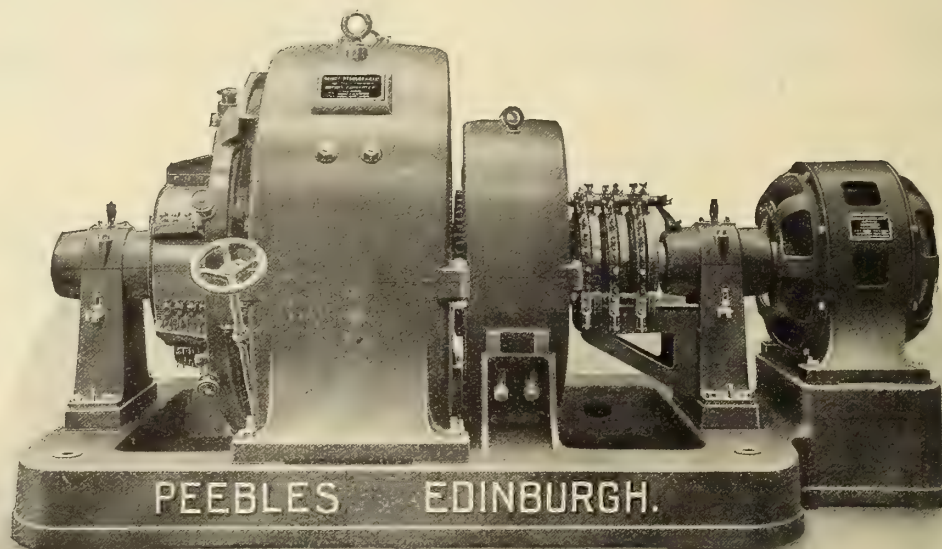
with

**MOTOR-CONVERTERS**

they also build

**ROTARIES**

for use on low frequencies.



Peebles rotary-converter with A. C. booster

**FERRANTI ELECTRICAL COMPANY OF CANADA**  
**LIMITED**

90 Sherbourne St.

**TORONTO**

Farmers Advocate Bldg.

**WINNIPEG**





## The All-Night Lamp

For porches, halls, bath rooms, nurseries, sick rooms, for all night burning, there is a big field of usefulness for the

## 10-Watt MAZDA Lamp

Teach your customers to burn these lamps **all night** and the result will be a surprising kilowatt consumption per month. Don't overlook the fact that a 10-watt lamp burning 10 hours is just as much revenue to the central station as a 100-watt lamp burning one hour. Moreover, the long hour burning of small lamps leads naturally to the more liberal use of the larger sizes.

We believe it good policy to encourage the greater use of 10-watt C.G.E. MAZDA Lamps. Get your customers to show their civic pride by keeping their porch lights or hall lights burning, or by some equally good means of showing illuminated house numbers. The results will more than justify the effort in getting this custom started.

# CANADIAN GENERAL ELECTRIC CO. LIMITED

*Manufacturers of Electrical Apparatus and Supplies  
for Railway, Light and Power Purposes*

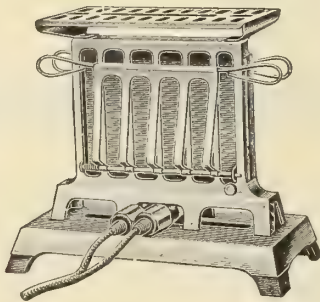
Head Office: Toronto. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert



# Hot Weather Helps to Your Summer Profits



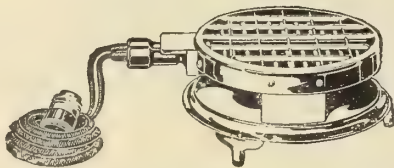
**T**HESE hot days make kitchen work doubly hard on a woman, and therefore twice as easy for the live dealer to sell her labor-saving electric utilities.



**O**F all the various makes these splendid products rank first in quality and therefore in permanent profit to you. They will stand up under the hardest usage and carry the double guarantee of the maker and the Northern Electric Company, Limited.



**P**ERSONAL service—the kind that makes you glad to do business with a big house—is yours on demand from the specialist at the nearest branch. And adequate stocks of irons, toasters, grills, coffee percolators, chafing dishes, water heaters, etc., etc., make it easy to fill your orders the day they come in. We enjoy giving that kind of service just as much as you appreciate getting it.



***Northern Electric Company***  
LIMITED

MONTREAL  
CALGARY

HALIFAX  
EDMONTON

TORONTO  
VANCOUVER

WINNIPEG

REGINA  
VICTORIA



# "Hot, Blue Sparks"

EVERY cell that bears the mark of Northern Electric quality is guaranteed to give entire satisfaction. Large stocks at branch houses. Wire, phone or write your order to

**Northern Electric Company**  
LIMITED



## BRANCH HOUSES AT

MONTREAL  
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VANCOUVER  
VICTORIA



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**The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers**



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The Canadian Bank of Commerce, Winnipeg, Man.  
A "GALVADUCT" Building

Darling & Pearson  
Architects

McDonald & Willson  
Electrical Contractors

**"GALVADUCT"**

The most perfect interior construction conduit on the market. Recognized as the standard of high quality.

Always specify Galvaduct or Loricated conduits

**"LORICATED"**

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

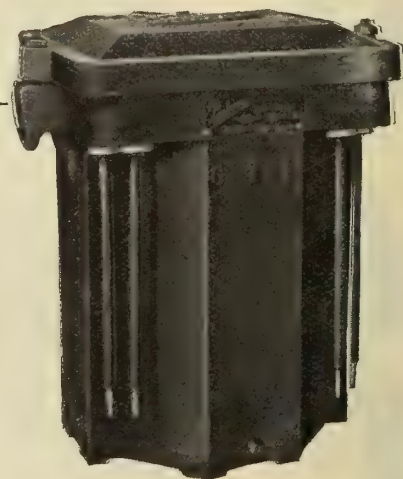
In the largest and most modern fireproof buildings in every part of the country you will find the electric wiring carried in Galvaduct or Loricated Conduits.

**Conduits Company  
Limited**

**Toronto - Montreal**

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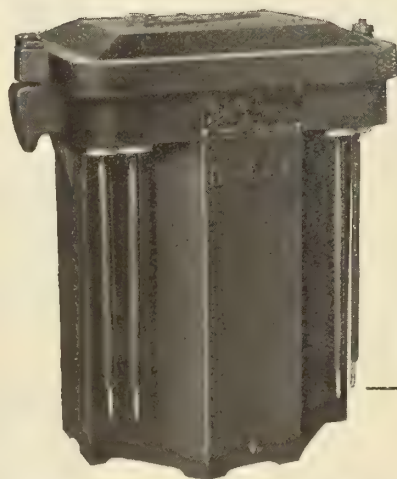




*Packard*

**DISTRIBUTING TRANSFORMERS**  
FOR  
**POWER and LIGHT**

Packard Transformers are designed to insure the highest efficiency in continuous service to the user. The superior quality of material and strong and rigid mechanical construction will effect a large saving in one year over ordinary transformers. It is the low cost of maintenance which makes the "Packard" so economical.



The **Packard Electric Co., Ltd.**

Factory at St. Catharines, Ont.

General Sales Office, N. W. Office and Warerooms  
Traders Bank Bldg., TORONTO WINNIPEG

LARGE STOCKS CARRIED AT

St. Catharines and Winnipeg; St. John Railway Co., St. John, N. B.;  
General Supplies, Limited, Calgary, Alta.;  
Rutel-Belnap Machinery Co., Canadian Express Building, Montreal, Que.





**Why try all the other types of lamps?**

**Buy Sunbeam Mazdas today and get satisfaction!**

*Made in Canada by*

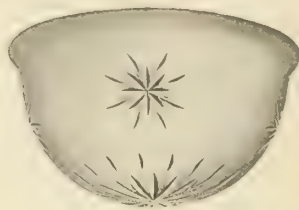
**The Canadian Sunbeam Lamp Co., Limited**

**Main Office and Factory: TORONTO**

**Branch Warehouses—MONTREAL, WINNIPEG, CALGARY, VANCOUVER**

*Adapted from Saturday Evening Post.*

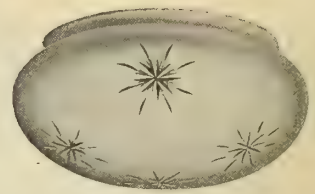




No. 579



No. 1043



No. 490



No. 1033

**E**XPERT workmanship on our cut shades and globes brings out the artistic and pleasing brilliancy that is intended.

Our new catalog No. 3 shows most of the standard cuttings.



No. 1030

**WRITE FOR CATALOG**

# JEFFERSON GLASS COMPANY LIMITED

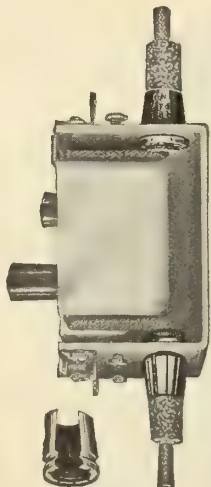
Head Office & Works  
**TORONTO**

Branch Sales Offices

{ MONTREAL.  
WINNIPEG.  
VANCOUVER.

# UNIVERSAL BUSHINGS

## FOR FLEXIBLE TUBING



No. 1&3 Universal Bushings  
Patented

Meet and overcome the many difficulties in holding flexible tubing securely in switch boxes, cabinets, outlet boxes and junction boxes.

They are one-piece bushings, easily and quickly installed without the use of tools, and can be removed for inspection and replaced without injuring bushing or tubing. **THEY SAVE TIME AND TROUBLE.**

UNIVERSAL BUSHINGS are made in four sizes which cover every condition in wiring.

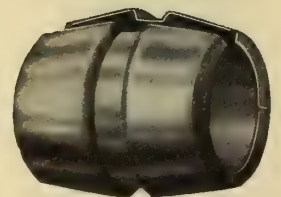
Nos. 1 & 3 for 5/8-in. knockouts; 7/32-in. and 1/4-in. tubing

Nos. 2 & 4 for 7/8-in. knockouts; 7/32-in. and 1/4-in. tubing.

We also manufacture FLEXIBLE TUBING CLAMPS for holding tubing at wall and ceiling outlets where boxes are not used. **TRY THEM.**

Approved by National Board of Fire Underwriters

*Write for prices and samples of these "Money Savers"*



No. 2 & 4 Universal Bushings  
Patented

# New Process Specialty Company, Inc.

MILWAUKEE,



WISCONSIN





Electric

# Flashlights—Batteries—Lamps



Every live dealer should handle them.

Practical and useful, a necessity.

Made in various styles and sizes.  
All flashlights absolutely guaranteed.

*Ask for catalogue.*

**Interstate Electric Novelty Co.  
of Canada, Limited**

220 King Street W., - Toronto, Ont.



## XCELADUCT GALVANIZED and ORPENITE ENAMELLED CONDUITS

These two brands of Interior Conduits represent the acme of Canadian made products.

**XCELADUCT** — this exceptionally high-grade galvanized conduit is made of easy-bending spellarized steel tubing. Copper subcoat and a zinc coating doubly protects it against rust, corrosion and atmospheric conditions.

**ORPENITE CONDUIT**—A specially prepared coating of enamel makes this conduit proof against rust and all weather conditions. It is made of easy-bending spellarized steel tubing.

In both brands of conduits the interior presents a smooth enamelled surface, which makes fishing rapid and easy—clean threads.

*If your jobber does not carry a stock—write us.*

**THE ORPEN CONDUIT CO., LIMITED.**  
TORONTO MONTREAL



**The Sign  
of  
QUALITY  
FIRST**

**ALWAYS SPECIFY "XCELADUCT" OR "ORPENITE."**



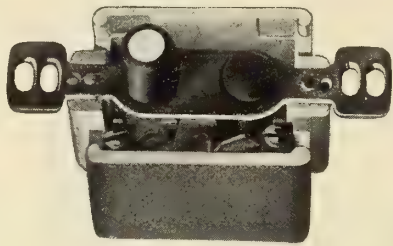
# SAFETY FIRST

This is Assured by Using

## Monarch Specialties

### Push Button Flush Switches

Single Pole, Double Pole, Three Way  
With or without Brass Plates  
Design and Construction Guarantees  
Durability, Accuracy in Operation.



*If your Jobber does not  
stock Monarch Speci-  
alties write direct.*

### Pull Chain Sockets

Supplied in Polish Brass, Brush Brass,  
Nickel Plate and Oxidize Copper  
Finish, From Stock, Other Finishes  
to Order.



## Monarch Electric Company, Limited

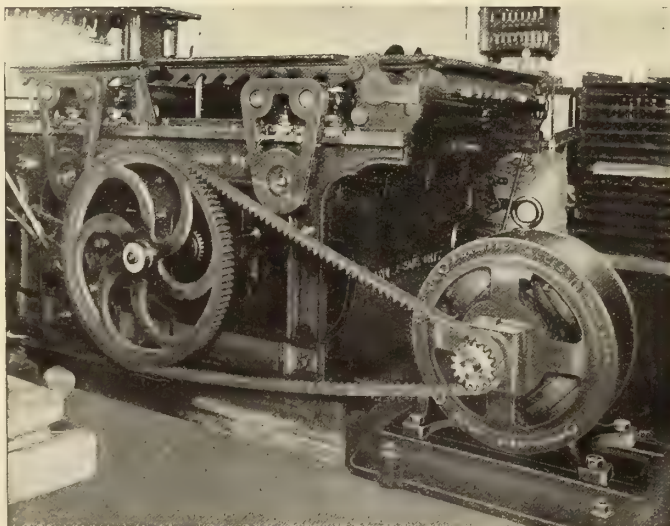
District of Montreal

ST. LAMBERT, P.Q.

## Operate Continuously

without any attention from the repair shop, as there are no points of weakness, either electrical or mechanical in

# VICKERS MOTORS



Vickers 8 H.P. Variable Speed Motor Driving Quad-Crown Letterpress Machine

Noted for simple design, strong construction, low temperature rise, high efficiency over a wide range of load, and high overload capacity.

Experience proves that the Vickers motor drive is the most convenient, reliable and economical for all classes of industrial machinery, from Bakeries to Refrigerating Plants.

The  
**Electric & Ordnance Accessories**  
Co., Ltd.

Works: Aston, Birmingham, England.



Head Office for Canada:

Lewis Building, 20 Bleury St., Montreal  
Mr. J. F. I. Thomas, (Representative)



# **“SAFETY FIRST”**

## **SURE!**

### **But Use**

### **I-T-E**

## **Circuit Breakers**

### **and have it**

## ***All The Time***

### **THE CUTTER COMPANY**

#### **PHILADELPHIA**

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The Cutter Co., Monadnock Block, Chicago, Ill.  
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Eccles & Smith Co., San Francisco, Cal.  
Eccles & Smith Co., Portland, Ore.  
Frank Darling & Co., Vancouver, B.C.





## Presturn Sockets

There is no trouble to get into, none to get out of, when you install Hubbell Presturn Sockets and other Hubbell specialties.

You'll never have to hold up a wiring job for lack of the right socket. A Hubbell jobber is in easy reach. The complete line of Presturn Sockets and all other Hubbell Electrical Specialties are in stock in Canada for immediate shipment in large or small lots.

**R. E. T. PRINGLE** New Birks Bldg. **Montreal**

## The Lachute Shuttle Co.

Lachute Mills, Que. **Limited**

### Manufacturers of

**CROSS ARMS** made from straight grained Douglas Fir, Long Leaf Yellow Pine and Red or Norway Pine.

*The largest manufacturers of Cross Arms in the East.*

**INSULATOR TOP PINS** made from Birch, Elm, Locust and Oak.

**BRACKETS** made from Birch and Oak.

**POLE STEPS** made from Oak.

**STRAIN PINS** made from Second growth Hickory.

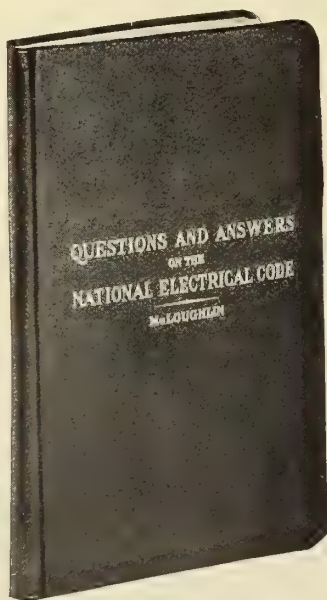
**SPECIAL PINS for HIGH VOLTAGE TRANSMISSION** made from Locust and Oak, all kinds and sizes.

All products boiled in Paraffine and Stearine or Creosoted if wanted.

**CORRESPONDENCE SOLICITED**

## You Can Interpret the Code Instantly with McLoughlin's

### Questions and Answers on the National Electrical Code



It tells at once the answer to the questions on code requirements.

Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.

Every question is carefully indexed so that you can locate the fact you are after instantly.

Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.

Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible

Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.

The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding \$1.00 net, prepaid.

*For Sale by*

**Electrical News,**

**220 King Street West, Toronto**



# Special Prices

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## ON

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# Electrical Books

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The Following Books are Offered Subject to  
Previous Sale

- The Steam Turbine, by Robert M. Neilson. Published in 1903 by Longmans, Green & Co., 294 pages, illustrated. Price \$1.00.
- Telegraphy, by Sir W. H. Preece, K.C.B., and Sir J. Sivewright, M.A. Published in 1905 by Longmans, Green & Co., 504 pages. Price \$1.00.
- Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company, 298 pages. Price 50c.
- Electrical Engineering, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price \$3.00.
- Radiation, Light & Illumination, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price \$2.50.
- Electric Motors, by Crocker & Arndt. Published in 1910 by D. Van Nostrand & Company. Price \$2.00.
- Short Course in Testing Machinery, by Morecroft and Hehrs. Published in 1911 by D. Van Nostrand & Company. Price \$1.
- Dynamo Electrical Machinery, by Sheldon & Hausman. Published in 1910 by D. Van Nostrand & Company. Price \$1.50.
- Electricity—Experimentally and Practically Applied, by Ashe. Published in 1910 by D. Van Nostrand & Co. Price \$1.00.
- The Dynamo (2 volumes), by Hawkins & Wallis. Published in 1909 by Whittaker & Company. Price \$4.00.
- Steam Turbines, by Kennedy. Published in 1910 by Whittaker & Company. Price \$1.00.
- Dynamo-Electric Machinery, by Francis B. Crocker, E.M. Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price \$1.00.
- Telephone Law, by A. H. McMillan. Published in 1908 by McGraw Publishing Company. 332 pages. Price \$1.50.
- Practical Methods of Electro-Chemistry, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price \$1.00.
- Treatise on Thermodynamics, by Dr. Max. Planck. Published in 1903. 272 pages. Price \$1.00.
- Text-Book of Electrochemistry, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price \$1.00.

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## Electrical News

220 King Street West

Toronto, Ontario

# Use the Railway's Trolley Poles



as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of

**ERECO**  
**Combination**  
**Railway**  
**Lighting Pole**  
**Fixtures**

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

Design No. 10015

**Electric Railway Equipment Co.**  
Cincinnati, Ohio

Designers

Canadian Representatives:

Manufacturers

Dawson &amp; Co., Limited, Montreal, Winnipeg

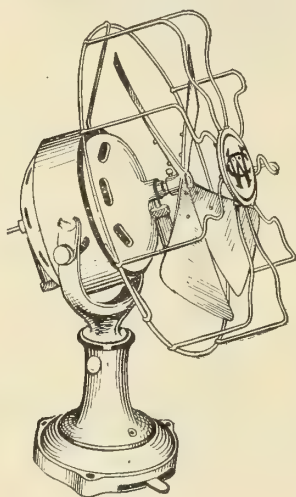
N. Y. Office, 30 Church St., Hudson Terminal Bldg.



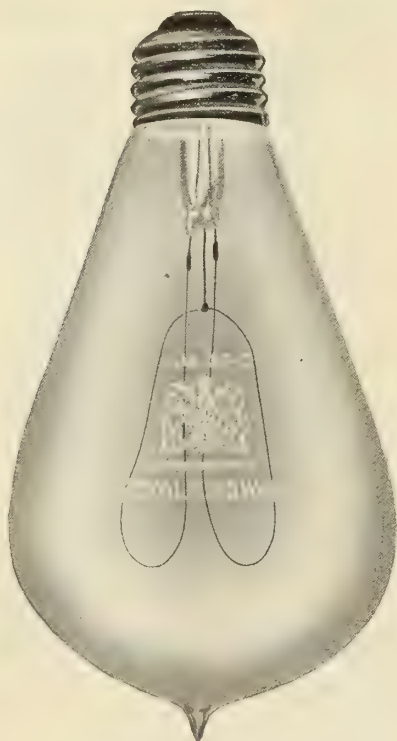
The MARK of



QUALITY



Oscillating  
Desk Type



No. 21 Bulb, 50 C. P.

## When you want an order of Fans in a Hurry

When you suddenly run short in some types or sizes of fans and send in a rush order to sort up your stock, you generally want that order **shipped in a hurry**, don't you?

Now look over your stock, make up a list of the types and sizes you are low in, because the real warm weather is just starting in now and you are going to need at least one sorting order, send the order in to us and your goods will be shipped the day we receive it.

We have a large stock of all the standard types and sizes on which we are quoting special low prices.

## We are sole Canadian agents for "ROYAL EDISWAN" CARBON FILAMENT LAMPS

In the manufacture of the "Royal Ediswan" Carbon Lamp, the makers have spared no effort to perfect a product of superior quality and maximum efficiency.

Those among your customers who prefer the carbon filament lamp will find in the "Royal Ediswan" a satisfaction which comes only from a high grade product.

Made in standard American bulbs, (also fancy bulbs) and built to standard specifications.

We are prepared to make prompt shipments on all orders—large or small.

## Chapman & Walker, Limited

118-120 Richmond St. West, TORONTO  
MONTREAL WINNIPEG VANCOUVER



# How's Your *Fan* Stock?

Are You Short In Some Types?

We have just received another large shipment of bracket and desk, oscillating and stationary types along with a good stock of extra parts. Let us know what types you need—we can supply you immediately.

## "Condor" Lamps

Write us for our "Early Delivery" contract terms for your fall and winter supply.

*Sole Canadian Distributors*

# C. H. Basters & Company

22 College Street, TORONTO, ONT.

# Pole Line Hardware

That Stands the Test of Time and Weather

WE MAKE ALL ARTICLES REQUIRED

**WIRES:** *Copper---Galvanized for Electrical Construction Work, etc.*

**ALL STYLES OF:** *Bolts, Nuts, Rivets, Washers and Screws, Pole Steps, Guy Clamps, Cross Arm Braces.*

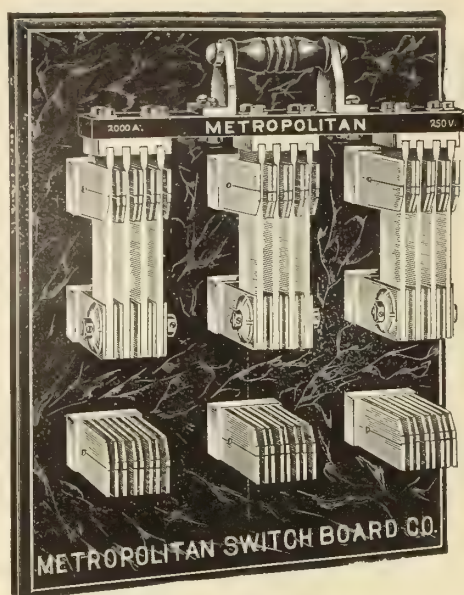
Send us your specifications to quote on.

Lowest Prices---Prompt Shipment.

The **Steel Company of Canada,** Limited

Hamilton Montreal Toronto Winnipeg Vancouver Victoria St. John, N.B. Halifax





TRADE **METROPOLITAN** MARK  
ELECTRIC MFG CO.

**Panelboards, Switchboards  
Knife Switches  
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*Send us your specifications, our price is right, and delivery the best.*

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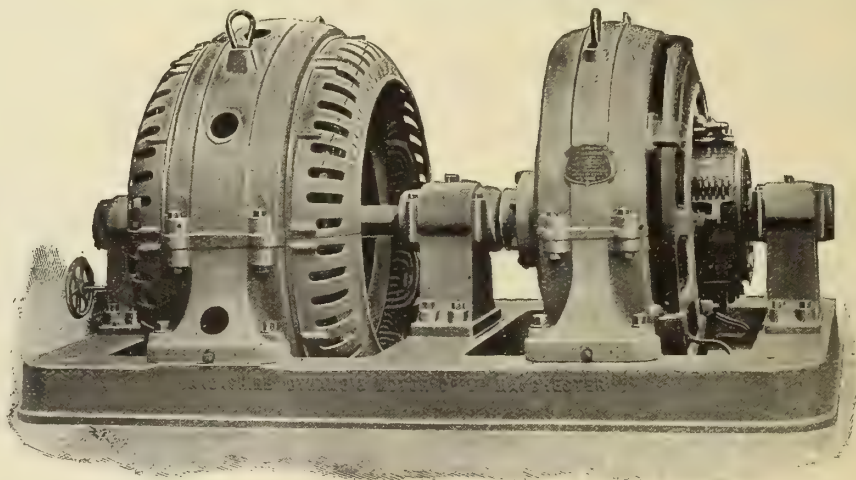
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# Electric Motors for all Purposes

Curve Drawing Meters. Portable Type for Factory Use

The  
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The  
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Patent Reversing  
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Motor Generator—300 K.W. for Traction Service.

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Designed and manufactured under the direction of practical and competent engineers of wide and varied experience

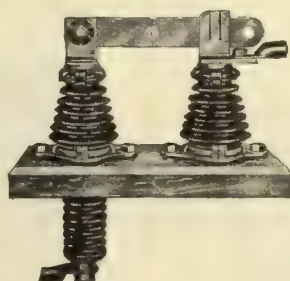
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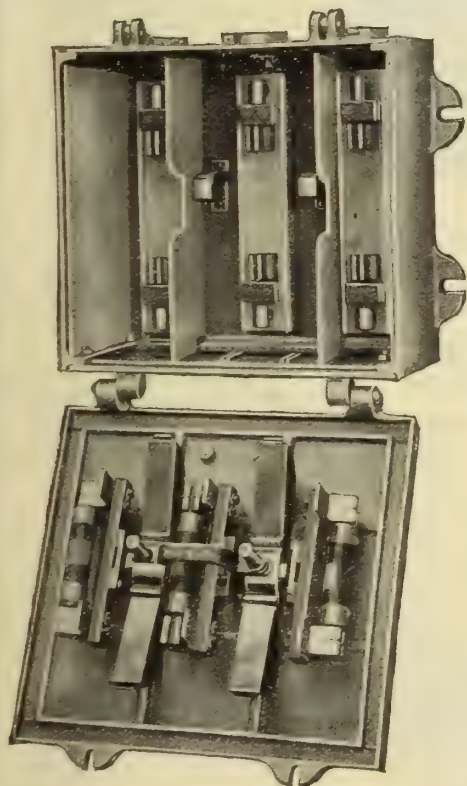
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Do not think only of loss by fire,  
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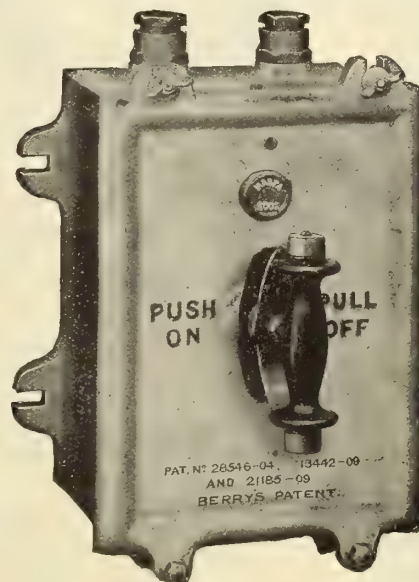
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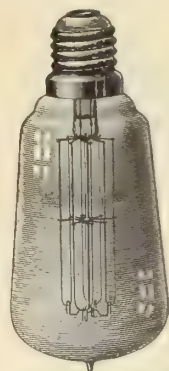
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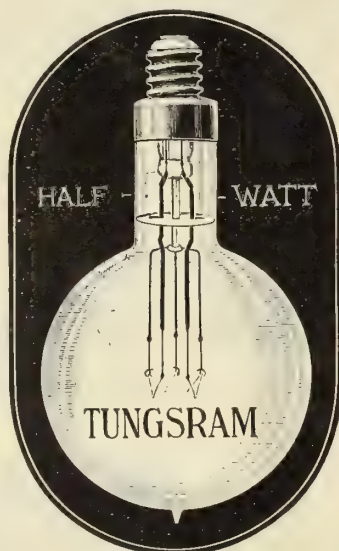
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See for bulletin 19

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For  
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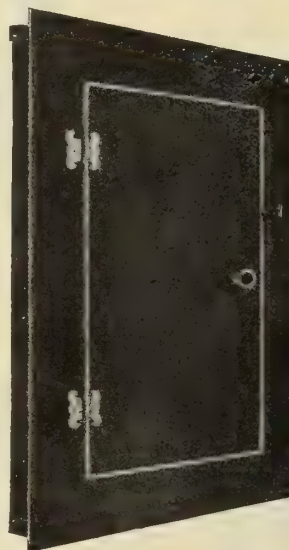
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We manufacture  
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We guarantee prompt  
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Standard sizes carried  
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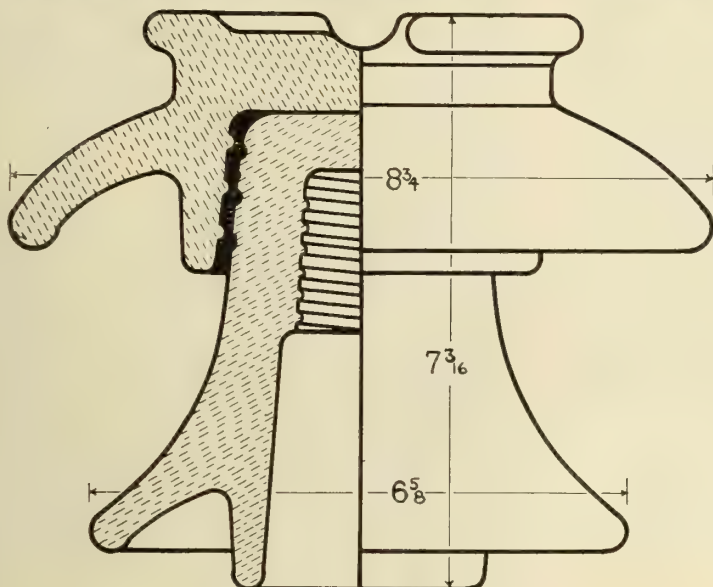
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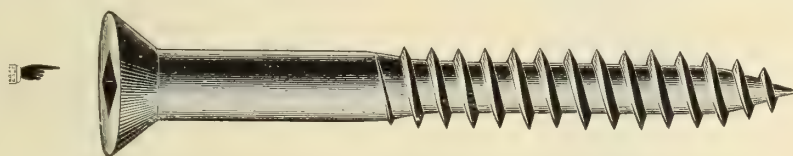


Number	133
Line voltage	30,000
Test voltage	100,000
Rain test	65,000
Leakage distance	17 3/4-in.
Pin hole	1 3/8-in.
Net weight	10 1/2-lbs.
Packed weight	12-lbs.
No. per crate	6

## The Canadian Porcelain Company, Limited

HAMILTON, - CANADA

SEE  
THAT  
SQUARE  
HOLE



PAT. FEB. 2, 1909

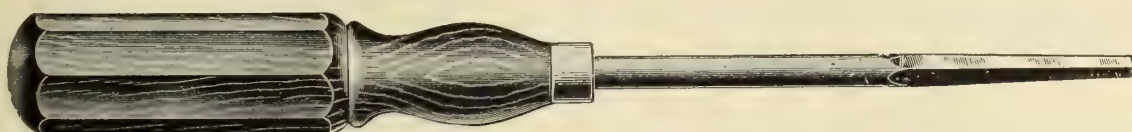
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The advantages of this wood screw are many. The screw may be placed on the driver and driven at arms length, with one hand. It is impossible for the driver to slip out of the socket.

Drivers are made in a variety of suitable styles.

For electrical wiring and fixture work, etc. this type of screw is unrivalled.

*Samples, prices and catalogue on request.*



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"Direct and Alternating Current Testing," by Bedell. Published in 1909 by D. Van Nostrand & Company. Price \$2.00.

"A Laboratory Manual of Alternating Currents" by John H. Morecroft, E.E. Published in 1912 by Renouf Publishing Company. Price \$2.00.

"Electricians' Operating and Testing Manual," by Henry C. Horstmann and Victor H. Tousley. Published in 1910 by Frederick J. Drake & Company. Price \$1.50.

"Telephony," by Samuel G. McMeen and Kempster B. Miller. Published in 1912 by the American School of Correspondence. Price \$3.00.

"Elevators, Hydraulic & Electric," by Calvin F. Swingle. Published in 1910 by Frederick J. Drake & Company. Price \$1.00.

"The Electric Motor and Its Practical Operation," by Elmer E. Burns. Published in 1912 by Joseph G. Branch Publishing Company. Price \$1.00.

"Electric Wiring & Lighting," by Charles E. Knox, E.E. Published in 1913 by the American School of Correspondence. Price \$1.50.

"Electric Arcs," by Clement D. Child, Ph.D. Published in 1913 by D. Van Nostrand Company. Price \$2.00.

"Conversations in Electricity," by Branch. Published in 1908 by the Branch Publishing Company. Price \$2.00.

"A. C. Machinery," by Esty. Published in 1912 by the American School of Correspondence. Price \$4.00.

"Wireless Telegraphy and Wireless Telephony," by Ashley-Hayward. Published in 1911 by the American School of Correspondence. Price \$1.50.

"American Electricians' Handbook," by Terrell Croft. Published in 1913 by McGraw-Hill Book Company, Inc. 750 pages, illustrated. Price \$3.00.

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## Campbell Automatic Time Switch



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—and you visit it  
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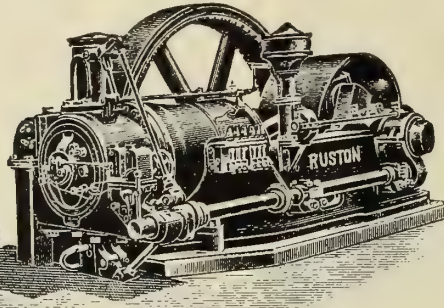
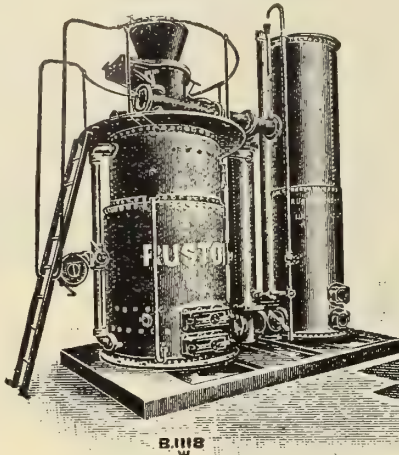


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**For Town Electric Lighting,  
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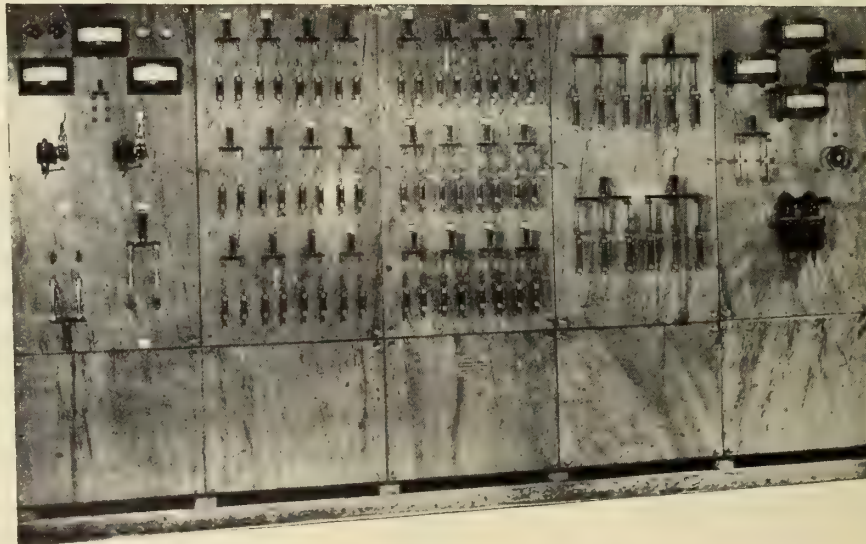
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Panels,  
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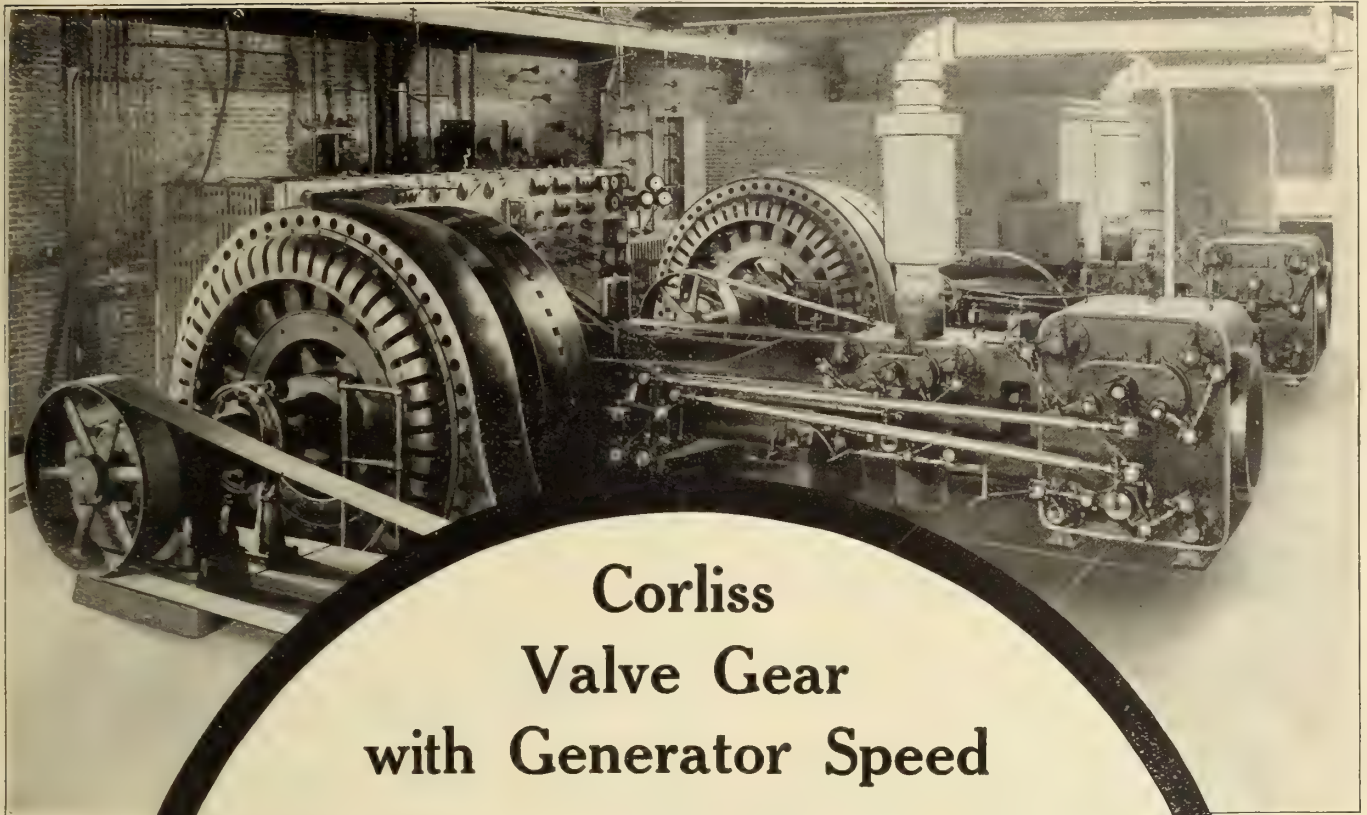
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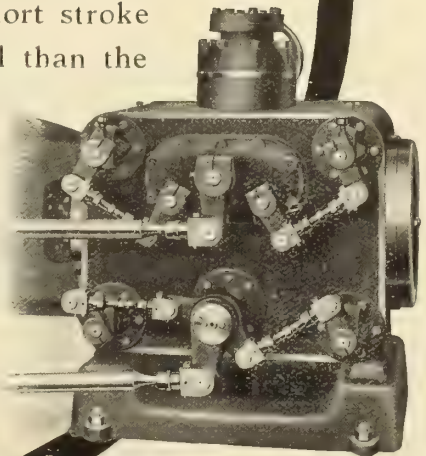
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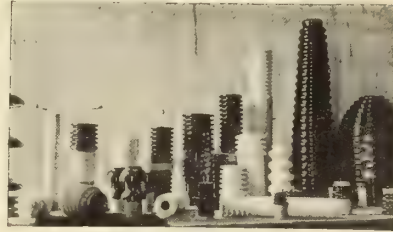
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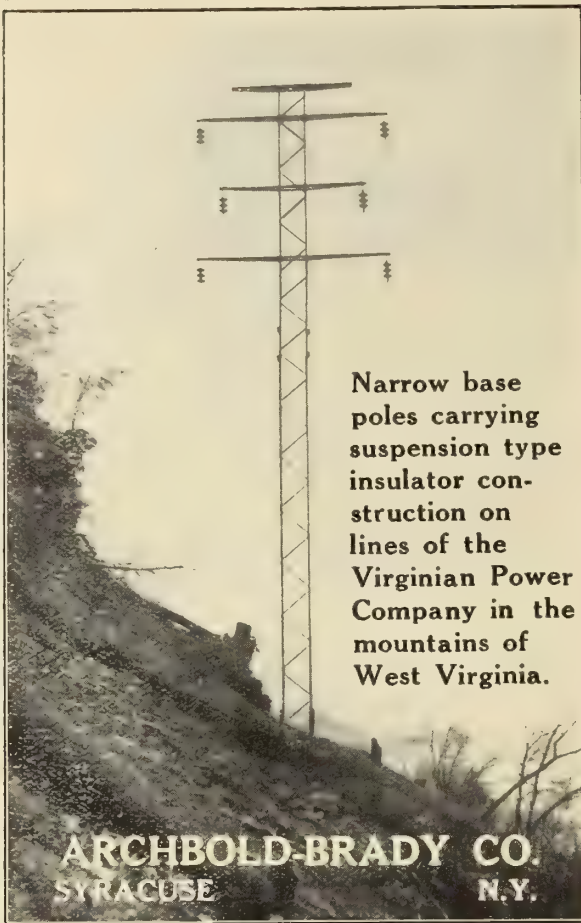
## The Electrical Apparatus Company, Ltd.

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South Lambeth Rd., London S. W., England

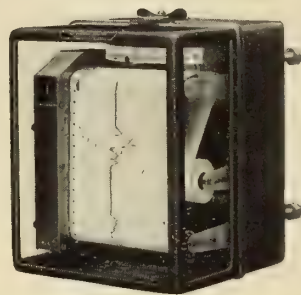
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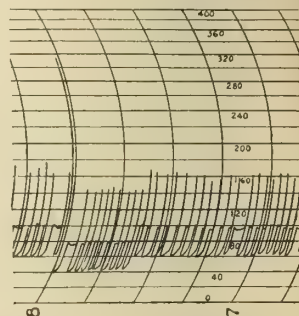
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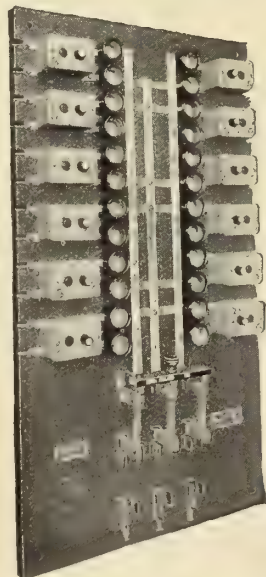
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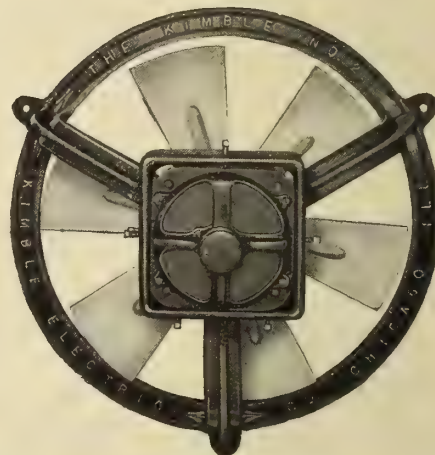
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## Dependable Bell Service

is lastingly insured by every installation of a

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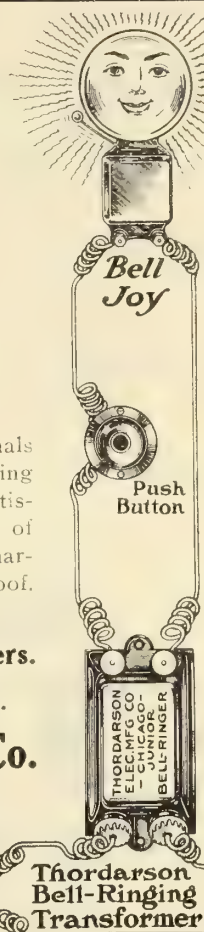
Operates door bells and other signals from the A.C. lighting circuit, replacing all batteries. It gives absolute satisfaction because it can not get out of order—ever. Our unconditional guarantee protects you. Moisture proof. Approved by the

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*We Manufacture*

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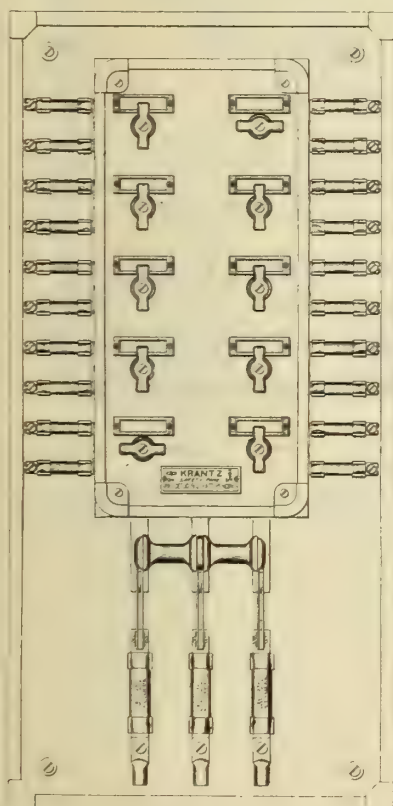
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make a strong appeal to the housewife for summer use. There must be many homes in your territory in which a Simplex Range could be sold, if its advantages were known. There is a size for every purpose, from the smallest kitchenette to the largest country house. You do yourself a good turn every time you recommend and sell a Simplex Range. It blazes the path for other Simplex goods and larger use of day current.

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besides increasing efficiency and safety, save time and labor on installation costs. Used for connections to panel boards, switchboards, busbars, switch and control gear, generator, converter and transformer apparatus, motors, and all shop wiring and apparatus

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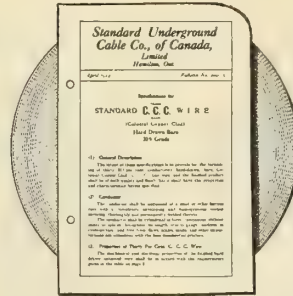
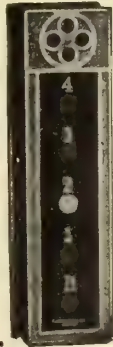
"Connecticut" Annunciators and "Connecticut" Interior Telephones appeal to the user because they are simple in construction, effective in action, look good, wear well and give lasting service.

Made in a wide variety of styles and sizes—each style suited to its particular requirement. You're selling satisfaction—making lasting customers—when you sell "Connecticut" goods.

Write for Catalog 22C and Full Details

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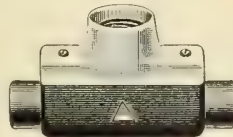
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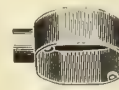
Cat. No. 9001—Rectangular Unilet.



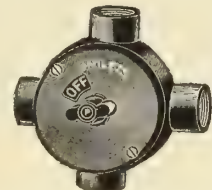
Cat. No. 9002—Rectangular Unilet.



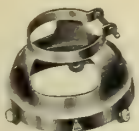
Type No. 2—Rectangular Unilet. Cat. No. 9002 with No. 7650 Receptacle.



Type No. 1 Octagon Unilet. Cat. No. 7501.



Type No. 4—Round Unilet with enclosed Snap Switch.



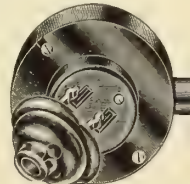
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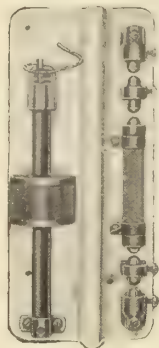
The Mainer Electric Co., Ltd., Winnipeg

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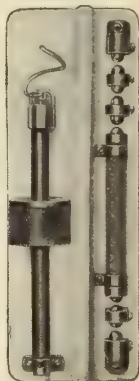
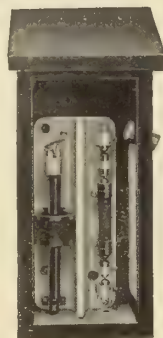
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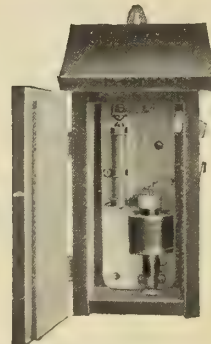
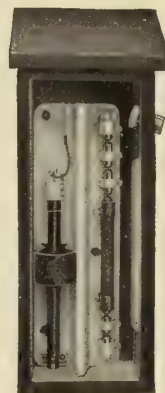
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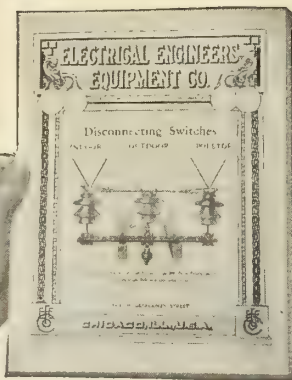
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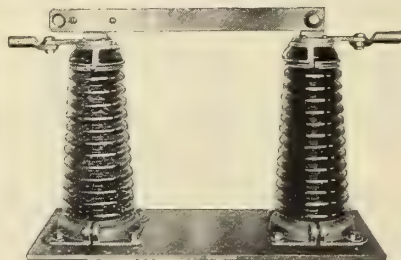
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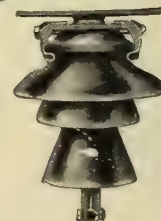
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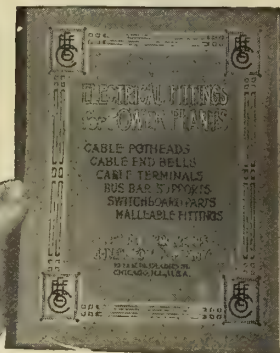
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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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Vol. 23

Toronto, July 15, 1914

No. 14

## Purifying Water by Electricity

The most recent developments in the purification of water indicate that the central stations will reap considerable benefit. Filtration apparently has its disadvantages, one of which is that it is exceedingly expensive both to install and maintain. The use of chloride of lime which has been practised very extensively in Toronto and has given most excellent results, is objectionable from the fact that few people care for the flavor it imparts to the water. The method of purification which is evidently increasing in popularity is sterilization by electricity in one form or another. The ozonizing process which has been used with considerable success at certain places on the European Continent, has now given way to the ultra violet method of purification. By those who have made a most careful study of the subject of purifying water this method is considered as certain to become very generally adopted in the next few years.

Briefly described, the sterilizing apparatus consists of a mercury vapor lamp enclosed in a quartz jacket, placed in actual contact with the water to be purified. In certain cases, the water is allowed to circulate around the lamp in such a way that it is pierced by the rays for a longer period. Where efficiency is not a very important factor, good results can be obtained by placing the lamp above the water and as close to it as possible. By the use of these lamps it is found that water bacteria are killed in a small fraction of a second. There is one essential in connection with this system of purifying, namely, the water must be perfectly clear, so that the rays will pass through without obstruction. It follows that the filtration system operating in series with a mercury vapor sterilizing system is an ideal arrangement.

From the central station point of view, the advantage will not be the size of the load so much as its satisfactory

nature. It is stated that from 50 to 130 kw.h. represents ample energy to purify 1,000,000 gallons. As this would represent the demands of a population of approximately 10,000 people, it can readily be determined what the load would be in villages, towns or cities of various sizes throughout the Dominion. For example, in Toronto, where the daily consumption is in the neighborhood of 60,000,000 gallons, the number of kw.h. of energy required for the purification of this amount would be 60 times 130 at the maximum, or 7,800 kw.h. This amount spread over the 24 hours would mean a steady load of something over 300 kw. It is, however, to be noted that this represents a load which would, practically speaking, not vary at all day or night, winter or summer.

The low current consumption, as shown in the last paragraph, is one of the important advantages to a municipality in this system of purification. Suppose municipalities were able to get a one cent rate for this amount of power load, the cost of sterilizing all the water used in the city of Toronto would be only \$78 a day. At the present time the big item of expenditure is the lamps. These are expensive to purchase and have a comparatively short life. There appears to be little doubt, however, that with developments in lamp manufacture the ultra violet method of water purification is destined to become very much more general in towns and cities of all sizes within the next few years.

## Ground Your Transformers

Central Station managements would do well to take to heart the recent Quebec decision which resulted adversely to an operating company because they did not have their distribution secondaries grounded, as advised by the National Code.

So far as we know, the law of Quebec does not make it necessary to ground transformer secondaries and the ruling is all the more significant in that it indicates that what is considered good practice by engineers and associations of good standing is as likely to regulate the ruling of a court of justice as a law actually placed upon the statute books.

In the particular case referred to, fire occurred as the result of a tree falling across the primary wires and bringing them into contact with the secondary wires which entered the building. The building was burned down and the insurance paid. Action was instituted however by the insurance company to recover from the electric company, their claim being based upon the argument that if the secondaries had been grounded, as good practice demands, fire would not have occurred. It was shown by defendants that the tree which caused the accident belonged to the owner of the building burned and it was claimed that the electric company could not be held responsible. The decision favored the insurance company at every point, however, and judgment was given for the full amount of the policy payment.

We understand there are still a considerable number of systems operating in Canada ungrounded. It is possible these may continue to operate for many years without accident, but in consideration of the facts that have been brought out in the last few years and the unanimous opinion of operating and consulting engineers in favor of grounding, it would appear to be nothing more than good insurance to take immediate steps to prevent accidents such as the above, to say nothing of many similar accidents often resulting fatally to operators and others that have occurred during the past two or three years. Doubtless the legislatures of the various provinces will soon make the change obligatory, but, in the mean time, it is evident that the absence of such a law does not relieve the operating company of responsibility. Quite aside from the humanitarian viewpoint the expenditure incurred in properly grounding every secondary system is likely to prove a good investment.



## The Electric Auto is Coming

The electric automobile appears to be winning its way rapidly not only as a town convenience but as a touring car. The Electric Vehicle Association of America is a live organization which has done much to popularize the use of the electric vehicle in the United States by systematic tests on the possibilities of the electric, and judicious advertising of the results.

Quite recently a paper was read before this association on the subject of "Touring By Electric Automobiles," and the data contained indicates that the day is not far distant when we shall not hesitate to venture outside the city limits with a storage battery car. One of the tours described in this paper started at Boston on October 14 and reached Chicago on October 31 having travelled a distance of 1,305 miles. The highest daily run was 173.5 miles between Syracuse and Buffalo. Apparently no great difficulties were experienced and excellent time was made. The paper also gives a list of runs, made on one charge of a battery, which vary in length from 103.2 miles at an average speed of 20.14 miles per hour to 27.3 miles at an average speed of 26 miles per hour. Another interesting report just to hand tells of an electric 1,000 lb. delivery wagon which made a trip from Buffalo to Lockport and back, 52 miles in all, and carried a 900-lb. load on the return trip, in the total time of 3½ hours. The current consumed on the round trip was only 105 ampere hours which at Buffalo's regular rate amounted to less than 10c. On another occasion the same car made a 70-mile trip on 130 ampere hours. The car in this trip travelled at high speed, as far as possible, all the way.

A very interesting item in the service report of the city of Memphis Police System states that the number of miles operated during 1913 was 18,529 and that the cost of battery maintenance during this time was nothing except the cost of battery solution, which amounted to \$11.92.

With such figures as these to reassure us we need not hesitate to be enthusiastic about the future of the storage battery car, not only for general delivery and city passenger traffic but for suburban work as well. The difficulty of course, lies, at the present time, in the considerable distance between charging stations. With perfection and simplification of charging apparatus, however, this will be remedied. Improvements may also confidently be looked for in battery capacity and life.

## A Fair Interest Return

In an address delivered recently before a public meeting in Toledo, where there has been considerable difficulty over the electric railway situation, Mr. Thos. N. McCarter, president of the Public Service Corporation of Newark, N.J., which practically controls the electric railway service in that state, spoke forcibly on a number of items of vital interest to the railway industry such as adequate fares, reasonable returns on capital, satisfactory relations existing between his corporation and the authorities of the state in which he operated, the proper time for a franchise to run, etc. Mr. McCarter as the president of a system which has yearly gross receipts of approximately \$16,000,000 of necessity speaks with authority and his statements will be read with unusual interest. He quoted figures to show that in New Jersey a 3c fare positively is not sufficient to pay the operating charges of their system. He also discussed in a very judicial way the question of interest return which shareholders who have invested their money in electric railway enterprises may naturally expect, and places this at 8 per cent. He points out that the hazards of the business, the probabilities that the early years will yield no interest returns at all and the difficulties of obtaining capital make this rate an absolute necessity. Another matter discussed by the speaker was the franchise question and it is interesting to

note that Mr. McCarter's opinion is that a short term franchise is very unsatisfactory from the standpoint of the municipality. We print an extract from the address on other pages of this issue.

## Japanese Electrical Progress

How greatly Japan has increased as a market for electrical goods may be understood from the fact that whereas in 1903 the capital invested in electrical supply undertakings and electric railways was £2,858,000, in 1911 it had increased to £47,163,000, and the last two years have, although statistics are not yet available, shown at least an equal rate of advance. During the same eight years the electric power for which sanction had been given rose from 44,000 kw. to 344,000 kw., the length of transmission lines from 5,981 to 33,584 miles, the length of electric railways from 93 to 704 miles, and the total power of electric motors installed from 3,000 kw. to 33,000 kw.

Native factories for the manufacture of motors, transformers, switchboards, the simpler forms of electric meters and other measuring instruments, electric lamps, electric wire, etc., have been established, but the more important classes of machinery, complicated instruments, most of the metal filament lamps, electric cable, etc., are all necessarily imported, and such oversea purchases continue steadily to increase. Thus Great Britain shipped to Japan in 1912, the last year for which returns are available, electrical machinery to the value of £242,683, against £232,690 in 1911, and £162,924 in 1910; also other electrical apparatus, including batteries, lamps, carbon rods, telegraph and telephone apparatus, and wires and cables, to £375,041, against £201,664 in 1911, and £279,328 in 1910, such figures providing fair evidence that, in spite of the growth of native factories for the manufacture of machinery and apparatus, the import trade is at a higher level than ever before, and indeed shows not the slightest sign of decline. In regard to the local manufacture of metal filament lamps, it is to be noted that the filaments have to be imported, and are made into lamps in native workshops under license. Even should the manufacture of dynamos at the Shibaura Works and of cable at the factory owned by the Yokohama Electric Wire Company prove ultimately successful—and there seems some prospect of this in the fact that at the former a dynamo of 6,000 kw. has been turned out—the market will still be a valuable one for importers, especially in regard to requirements in connection with large installations.—(British Export Gazette).

## Canadian National Exhibition

The management of Canada's world-renowned National exhibition have just issued their first bulletin which describes, in part, a number of interesting features in connection with this year's show. The date set is from August 29th to September 14th. Numerous inquiries have already been received regarding space for exhibits from points never before represented, which indicates that this will be the best year our National Exhibition has ever known. Electricity will play a larger part this year than ever in its power, lighting and decorative applications. The system of electric ornamentation that has been developing during the past few years will be practically complete this year. The Grand Plaza will be canopied with electric stars. The Fountain will be illuminated and various devices symbolic of Peace Year will be utilized to further beautify the grounds. Among the entertainment attractions might be mentioned:—daily hydro-aeroplane flights, Grenadier Guards Band, Guiseppe Creatore's Band, and the International Peace Tattoo in which ten bands will take part in the celebration of 100 years of peace between Great Britain and the United States.



## Grounding Secondaries

Mr. Justice Dorion, sitting in Quebec, on July 3 gave judgment in two actions against the Quebec Railway, Light, Heat and Power Company, this being the first judgment of this character since the National Electrical Code made grounding obligatory. The plaintiffs were the Guardian Assurance, Liverpool & London Assurance, Phoenix Assurance and Queen Assurance Companies, and Mr. G. A. Vandry, and the actions were to recover damages caused by fire through a branch of a tree falling during a storm and causing the primary wires of the lighting system to come into contact with the secondary wires, supplying a number of customers from a transformer which was not grounded. Two buildings were destroyed, and the insurance companies paid the sum of \$18,152. The companies sued the defendants for this amount on the ground that the transformer secondary neutral should have been grounded. The court gave judgment for the full amount with interest and costs, holding that the plea of the defendants that the tree (which belonged to one of the parties) was a known hazard and should be provided against, was insufficient. It considered that the company were responsible for the damage, in view of the fact that they had not grounded their transformers, as recommended. He also gave judgment for \$7,443 with interest and costs in favor of Mr. Vandry,—a total of \$25,596. Dr. Herdt and Messrs. J. Bennett, R. M. Wilson, and J. M. Robertson, of Montreal, were witnesses in the case.

## Abitibi Pulp & Paper Company

The electrical work in connection with the plant of the Abitibi Pulp & Paper Company, at Iroquois Falls, Ontario, is now well advanced. This work consists of installation of conduit work, exposed work, outside line work, generator leads to large water turbine-driven generators and complete electrical distribution for light and power. The generators have a capacity of 1250 kv.a., 600 volt, 3-phase, 60-cycle. The current for the lighting is stepped down by means of transformers to 110-220, single phase.

The power distribution is of special interest, consisting of connections from switchboard to the following motors:

- 2—150 h.p. screen motors.
- 2— 85 h.p. wet machine motors.
- 2— 75 h.p. white water pump motors.
- 2—150 h.p. refinery motors.
- 1— 25 h.p. machine shop motor.
- 1— 20 h.p. elevator motor.
- 1— 30 h.p. save-all motor.
- 1—250 h.p. mill water supply pump motor.

The above motors are situated in screen room at an approximate distance of 500 feet from the power house. Feeders to this building are run from the power house over roof of grinder room and thence on poles to the screen room. These feeders are made up of six 500,000 c.m. cables.

In addition to the above, in the wood repairing room there are the following motors:

- 1—150 h.p. hydraulic pressure pump motor.
- 1—125 h.p. saw slasher motor.
- 1— 25 h.p. conveyor motor.
- 1—150 h.p. Barker line shaft motor.

This room is fed by three 600,000 c.m. cables. This is run on pole lines outside from the power house at a distance of about 350 feet.

The motor equipment in pump room is as follows:

- 1—250 h.p. mill water supply pump motor.
- 1—250 h.p. ground wood stock pump motor.
- 2—200 h.p. ground wood stock pump motors.
- 2— 40 h.p. grinder pressure pump motors.
- 2— 15 h.p. conveyor motors.
- 1—10 h.p. silver screen motor.

The complete motor capacity of the plant approximates

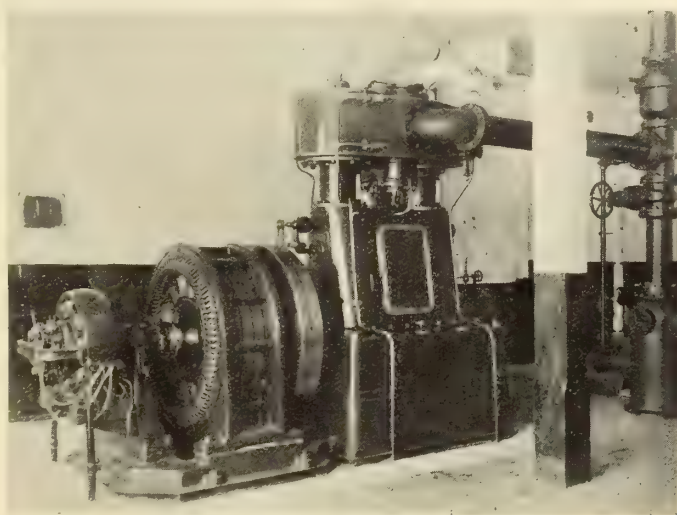
3,000 h.p. All machinery in connection with the plant is electrically driven except the large wood grinders, which are located in a room adjacent to the power house and which are driven by water turbines. The cables used inside the building are all of special manufacture, being of varnished cambric insulation enclosed in iron conduit. The entire installation is in accordance with the latest rules of the Associated Factory Mutual Fire Insurance Companies. The complete electrical installation is in charge of L. K. Comstock & Co., Montreal.

## C. E. A. Officers

The officers of the Canadian Electrical Association for the year 1914-15 elected at the executive meeting held during the recent convention in Montreal are as follows:—President, Col. D. R. Street; first vice-president, D. H. McDougall; second vice-president, R. M. Wilson; third vice-president, Wills MacLachlan; honorary secretary, T. S. Young; secretary-treasurer, Alan Sullivan; managing committee, J. S. Gould, G. W. Magalhaes, P. T. Davies, H. G. Matthews, A. E. Dunlop, J. S. Norris, Geo. Kidd, Robin Boyle, W. G. Angus, W. S. Robertson, E. L. Milliken, L. W. Pratt, H. R. Mallison, G. Ratcliffe Hulme. By a unanimous vote the president of the N. E. L. A. will in future be ex-officio a member of the executive.

## New Plant in Wingham

The Corporation of Wingham, Ont., recently added to its electrical plant a compact and serviceable engine-driven unit. The generator is 187½ kv.a., 450 r.p.m., 2300 volt, 3-phase, 60 cycle, with direct connected exciter 8½ kw. 125 volt, built by the Canadian General Electric Company. It is driven by a Goldie & McCulloch vertical two crank compound enclosed forced lubrication engine arranged to run



New Engine-Generator Set in Wingham, Ont.

either condensing or non-condensing, the condensing plant being of the jet type with direct coupled steam cylinder and air and water pumps. The high pressure valve is of the expansion type under the control of the governor through a telescopic rod, one of the advantages of this arrangement being that the position of the cut-off in the high pressure cylinder can be changed while the engine is running, if desired, or the expansion principle can be cut out altogether and the engine run on the throttle governor only. The type of governing used on the Goldie & McCulloch engines makes them very flexible when driving alternators running in parallel with other alternators driven by different types of engines on which the governing may not be as good as desired,



as by altering the position of a stop on the expansion rod the engine can be made to take the greater share of the load itself or force it on the other engines and generators as may be found necessary or desirable.

The panel for controlling this generator, also built by the Canadian General Electric Company, forms an extension to the existing blue Vermont marble switchboard, and is equipped with 2 pump brackets, 1 a.c. ammeter with 3-phase transfer switch, 1 field ammeter, 1 a.c. voltmeter, 2 rheostats, 1 synchronizing receptacle, 1 three-phase potential receptacle, 1 field switch, 1 automatic form K3 oil switch, 1 polyphase watt-hour meter, 2 current transformers, 2 potential transformers. On a swinging bracket at the left side of the switchboard are mounted:—1 synchronism indicator, 1 a.c. bus voltmeter, 1 power factor indicator connected to show the power factor of the station.

The plant is in charge of Mr. H. Campbell, manager and superintendent.

### Safety First

That the Safety First movement is producing real results is being evidenced every day by the reduction in the number of accidents which have come to be looked upon as necessary under certain fixed conditions. For example, our neighbors to the south have considered it obligatory in the interests of patriotism to kill off a considerable percentage of their population on July 4th by fireworks, gun powder explosions and other apparently, to us, superfluous demonstrations. This year's record, however, shows that in New York city not a single fatal accident occurred and the best reports to date show that only twelve people were fatally injured in the whole of the United States as a result of the demonstrations on July 4th of the present year. Though this figure of twelve seems to be ridiculously large it is very small compared with the fatalities of the immediately preceding years and indicates that the Safety First idea is becoming impressed upon the average mind with salutary results.

The movement in Ontario has resulted in the formation of the Ontario Safety League, which is doing increasingly good advertising work by distributing literature, by giving lectures, by moving picture demonstrations, and above all by reaching the school children and impressing upon them, early in life, that it is more important to be sure than sorry. The most casual observer will have noted the difference in the attitude of Toronto children towards hurrying across the street, rushing to the scene of an accident, approaching wires of any kind, and in many other ways. The natural childish thoughtlessness and recklessness is plainly giving place, in a very marked degree, to caution and watchfulness, a condition which Ontario's parents note with the greatest satisfaction and approval.

One of the pamphlets of the Ontario Safety League has just come into our hands and though its contents have been pretty widely advertised we print extracts from it believing that too much publicity cannot be given to this altogether meritorious movement. Particularly we wish to draw attention to the fact that the work of this league is entirely dependent upon public subscription and that such a great humanitarian movement deserves the support of every good citizen. The amount of money expended to date has not been large. There are no high salaried officials and, indeed, it may be said that the work so far has been one of love on the part of the most active and enthusiastic members and officers. Entirely aside from salaries, however, the expense of educational campaigning is necessarily considerable and the league will be grateful at all times for financial assistance to enable them to carry out their work still more effectively. Mr. J. F. H. Wyse is organizer and engineer of the league; Mr. R. B. Morley is secretary-treasurer. Temporary offices have been taken at Room 25, 34 Victoria St., Toronto.

We quote the following extracts from the bulletin mentioned above.

The Ontario Safety League is an educational organization formed late in 1913 upon the suggestion of the Ontario Railway and Municipal Board. Its chief aim is to teach the public at large to think of SAFETY as the first consideration. The campaign is being conducted along educational lines principally, as it has been clearly shown, in other cities, that the greatest reduction in accidents has been made by teaching the public to exercise constant care and unremitting caution. The success of the public safety movement in the United States is ample justification for the work in this province.

The number of accidents, fatal and non-fatal, occurring on the streets, has increased to an appalling extent in recent years. This is due to narrow streets, congestion of traffic, the increasing use of motors and other fast-travelling vehicles, together with the thoughtlessness of a large section of the public, both in vehicles and on foot. The Ontario Safety League has the following objects and, with the full co-operation of the general public, can do a great work in lessening the accidents upon our streets:—

To safeguard and protect the public, especially children, from the dangers of automobiles, railroads, street railways and all forms of vehicular traffic on the public highways in this Province.

To educate the public through schools, churches, literature and all channels of publicity upon matters pertinent to public safety.

To minimize the injuring and killing of persons employed in stores, factories, workshops and all departments of industrial and mercantile activity, by instilling into the minds of employer and employee the full meaning of "SAFETY FIRST."

To co-operate, so far as lies in the power of the League, in preventing the useless destruction of life and property by fire.

To educate and secure possible remedies and preventatives, and to assist in the enactment and enforcement of ordinances requisite to carry out the foregoing.

Local Leagues will be organized in different parts of the Province as quickly as possible. These local councils will, to a great extent, direct their own work, but will be at all times under the direction of the parent League in Toronto.

The League is entirely dependent upon public subscription to carry on this great humanitarian movement and for that reason a general appeal is being made.

The work is of vital importance to every man, woman and child in the province, and all may assist in this crusade. The following are the different classes of membership:—

Associate Members—Twenty-five cents per annum.

Active Members—One Dollar per annum.

Patrons—Five Dollars per annum.

Sustaining Members—From Ten Dollars upwards per annum.

#### "Safety First"

Think just what these words mean, and then make Safety your first consideration.

Remember that it is better to cause a delay than an accident.

Don't take dangerous and unnecessary chances.

Eyes left till you reach the centre of the street, then, eyes right!

"An ounce of prevention is worth a pound of cure."

Don't run in front of a moving vehicle—that is not "SAFETY FIRST."

Help the children. Teach the young idea "SAFETY FIRST."

It is better to be careful a thousand times than crippled once.

Never board a moving car—a few seconds gained is a poor recompense for a limb lost.

**Safety First, Last and Always**



# Outdoor Switching Equipments

By W. H. Acker and C. A. Harrington

In the natural growth and extension of a high tension transmission system the need for sectionalizing equipment on the main arteries is very soon manifest in order to facilitate the segregation and cutting out of portions of the lines which may develop trouble. The construction of tap-off or branch lines from the main circuits further increases the necessity for suitable disconnecting arrangements, such circuits being of relatively minor importance as compared with the main lines. The connections entering sub-stations, either tapping-off the main transmission circuits or served from these tap-off or branch lines must in many cases be provided with outdoor disconnecting and switching or selector equipment in order that the sub-station may be disconnected and isolated from the system in case of serious trouble or fire in same; and further, in order that the service connections supplied through the sub-station may be readily transferred by means of outdoor selector switches from one high voltage circuit to another, where double circuit transmission is used, without this service being interrupted.

It is always, of course, extremely desirable and in many cases absolutely necessary that these outdoor disconnecting, switching and selector arrangements be dependable, simple and inexpensive. Very often they are infrequently used but when needed must be operated quickly and positively, while at the same time the connected load which may be

showing locations of outdoor air break and indoor oil switches. Under normal operating conditions the power stations at Youngstown, Lowellville and Ellwood City are operating in parallel through the transmission system, the main portion of which is double circuit. Automatic oil circuit breakers are provided on all high tension feeders leaving the various power stations, and all synchronizing of power stations into the system is done across these oil circuit breakers.

All outdoor switching is taken care of with the horn gap air break switches.

The air break switching stations consist of a suitable timber framing on which the switches are mounted, and an

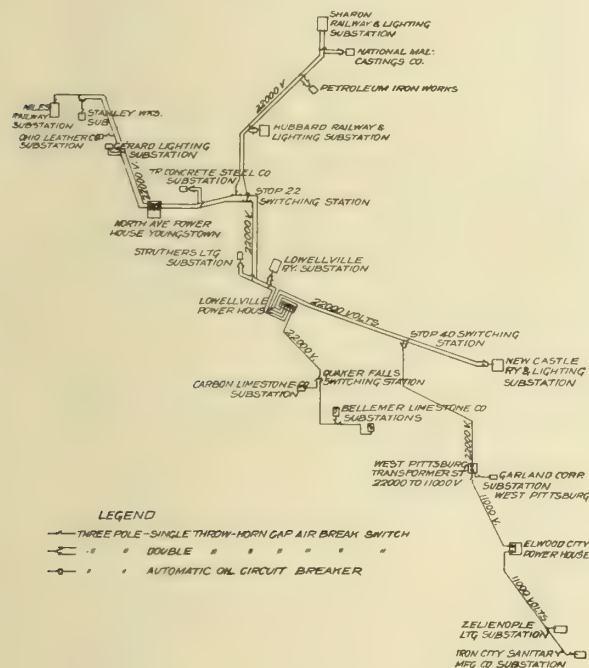


Fig. 1

fed through the switch is very small and the revenue derived therefrom would not warrant an expensive arrangement.

It is only within the last few years that the horn-gap air-break switch has come into prominent use for outdoor switching and sectionalizing of high tension transmission lines, taking care of just such conditions as are above outlined.

On the transmission system of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, there are eighteen such outdoor air break switching stations and a total of thirty-two three single-throw and one-three double-throw horn gap air break switches installed on same. Typical stations on this system are illustrated herewith.

Fig. 1 is a one-line diagram of the transmission system

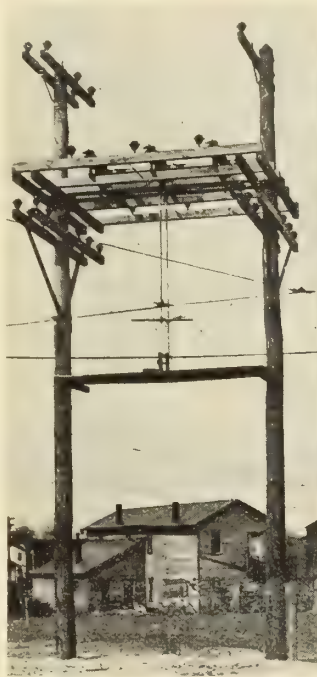


Fig. 2



Fig. 3

operating platform located from ten to twelve feet below the switch framing, from which the switches are operated. In most cases the switching station is supported from ordinary wooden poles. The arrangement of the switches, wiring and operating handles varies considerably and depends entirely upon the operating conditions, all switching stations being duplicates where the same conditions have to be cared for. The handles for operating the air break switches are all of wood, grounded galvanized iron pipe operating mechanism, previously used, having been replaced in order to eliminate the grounding of the metallic frame of the switch. In some cases these wooden operating handles are arranged so that they interlock the two air switches on the platform in such a manner that both switches cannot be in a closed position at the same time, thus making it impossible for the two transmission circuits to be paralleled at stations so equipped. At other switching stations where it may be desirable to parallel the two high voltage circuits while transferring the load from one circuit to the other, the interlocking of the operating handles has been omitted.

The following photographs of several different switching towers designed to meet various and very different operating conditions, show how readily the horn gap air break switch can be adapted and arranged to take care of disconnecting, sectionalizing and selector switching problems.

Fig. 2 shows a switching tower on which two switches are mounted. The double circuit transmission lines come onto the tower just below the framing on which the switches are mounted and the single circuit into the sub-station leaves the tower on top. The galvanized iron operating rods have



since been changed to wood. The handles operating these switches are not interlocked and the station attendant may parallel the transmission circuit upon receipt of the necessary orders. In case of power interruption the switch which is closed may be opened and the other switch may be closed and service resumed without waiting for orders.

The switching tower shown in Fig. 3 was designed to take care of the same conditions as in Fig. 2, with the exception that it was necessary to bring the two high voltage transmission circuits in on the top and run the single circuit into the sub-station from below the framing for the switches. A large number of the switching towers are duplicates of Fig. 3.



Fig. 4

The switching station shown in Fig. 4 is mounted on top of a steel frame factory building, the sub-station apparatus being located below on gallery floors. Two three-pole single-throw air break switches are mounted on the wooden framing on top. The two transmission circuits come on to the structures below the switches, and on the outside.

The single circuit from the switches to the roof bushings leaves the structure below the switches, and is between the two transmission circuits. The wooden operating rods for the switches are interlocked by means of the horizontal operating handles, so that the two switches cannot be in closed position at the same time, thus paralleling the two transmission circuits.

The view shown in Fig. 5 is of a sectionalizing switching tower at the junction of six three-phase transmission circuits. Six three-pole single-throw air break switches are used and are arranged so that any circuit leaving the tower may be cut out independent of the other circuits. No arrangement for paralleling the circuits is provided, the duplicate transmission lines being independently sectionalized on opposite ends of the tower.

The Outremont, P.Q., council have awarded a number of contracts in connection with their proposed public lighting and fire alarm and police signal systems. The order for 1200 nitrogen filled lamps was given to the Northern Electric Company, and that for six regulating transformers to the Canadian General Electric. Mr. G. M. Gest obtained the contract for erecting 125 combination trolley and lighting standards and 375 lighting standards, and for laying 74,800 feet of single conductor cable, 22,440 feet of two conductor cable and 19,000 feet of lead covered cable. The contract is on a ten per cent. commission basis. The Northern Electric will supply the apparatus for the fire alarm and signal system, for \$11,291, the total cost of the work being estimated at about \$17,000. Dr. L. Herdt is the consulting engineer.

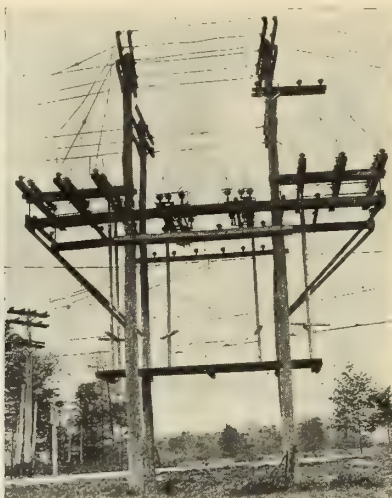


Fig. 5

## Aluminium Insulated Cables

By E. V. Pannell, A.M.I.E.E.

Doubtless many engineers who have called for alternative tenders for copper and aluminium cables have been disappointed to find that the quoted prices do not show the economy in favor of the latter that might reasonably be expected, taking into account the current market rates of the two metals. It does not necessarily follow, however, that the cost of producing an article has any direct bearing on the selling price. An analysis of the comparative manufacturing costs has therefore been made, and the results checked with the terms upon which business has actually been placed, and it is suggested that these figures throw light on the true economic relationship between copper and aluminium cables.

The three main objections which are raised against the adoption of aluminium for insulated cables may be briefly set forth as follows:—

- (1) That the economy is doubtful;
- (2) That the metal is difficult to work and joint;
- (3) That the scrap value is low.

Were these assertions sustainable it would be unnecessary to proceed with a detailed analysis, and it is therefore proposed to deal with them at the outset, with a view to satisfying financier and engineer alike that the subject is worthy of investigation to a logical conclusion.

### Economic Considerations

The specific gravity of annealed aluminium wire is 2.71 and that of copper 8.89; for a given volume, therefore, copper is approximately 3.3 times the weight of aluminium. The average conductivity of aluminium supplied for electrical purposes being 61 per cent. of the International Resistance Standard for copper, it follows that the sectional area will be 1.642 that of a copper conductor of the same length and resistance. The weight ratio on the basis of equal resistance is therefore copper, 3.3; aluminium, 1.642—or approximately 2 to 1. That is to say, for every 2 lbs. of copper, 1 lb. of aluminium will do the work, and the latter must therefore show a definite saving at anything under double the market price of copper.

At present average rates the price of Aluminium exceeds that of copper only by some 30 per cent., and thus it will be clear that a substantial margin of economy is assured by the employment of aluminium in place of bare copper strand.

Admittedly the insulation and protection of such conductors places a modified aspect on the question of economy, the larger diameter of the aluminium core postulating a relatively larger area to insulate. But the initial saving on the strand, even in the smaller gauges, will as a general rule be found to meet this extra expense with a useful balance in hand, while it will be obvious that as the area of the conductor increases the greater does this economy become and the more apparent the advantage in specifying aluminium. Take a typical instance where an electrical company decide to augment their distribution system by, say, 7½ miles of 600 volt paper insulated, lead covered and jute compounded feeder cable, of 1 sq. in. sectional area in copper, manufactured to the specification of the British Engineering Standards Committee. With copper wire at 9d. and aluminium at 11d. per lb. respectively, the relative cost of the cable, allowing for an equal ratio of profit on wages and raw material, would be:—

Copper cable, per mile . . . . . £1120

Aluminium cable, per mile . . . . . 860

Balance in favor of aluminium, per mile £260

or £1950 on the 7½ mile section, a saving of 23 per cent. on the cable. Where ducts do not already exist, the additional capital required for these and for labor charges, joint boxes,



etc., will reduce the above percentage to approximately 15 per cent. economy on the complete installation, subject to slight modifications depending on the particular system of cable laying adopted.

It is true that heavily armoured high tension cable will not show aluminium to the same advantage, particularly when the cores are of relatively small cross section. But, ignoring for the moment the technical superiority of a large core in dealing with high pressures, the fact remains that even in this class a valuable saving may be effected, a fact that Continental engineers have taken full advantage of in large contracts recently placed.

Perhaps this is best demonstrated by assuming that the electrical undertaking, before mentioned, desire to increase their supply facilities by about 6,000 kw., and that economical considerations decide in favor of obtaining this power in bulk from a neighboring station. Allowing for  $7\frac{1}{2}$  miles of 3 core, 6,600 volt cable, insulated with impregnated paper, lead covered and double steel tape armoured, designed for laying direct in the ground, the cost per mile of such cable on the same basis as in the previous example, would be:—

Copper cable, per mile . . . . .	£1912	0	0
Aluminium cable, per mile . . . . .	1809	10	0

Balance in favor of aluminium per mile. £102 10 0 or £768 15s 0d. on the  $7\frac{1}{2}$  mile section, a percentage economy of nearly  $5\frac{1}{2}$  per cent. In addition, the larger aluminium core increases by some 10 per cent. the over load capacity, and materially reduces the stresses on the dielectric. It should be borne in mind that where extra high pressures are called for, it is necessary in any case to increase the diameter of the core, in order to avoid undue stress; this point alone led to the installation of an E. H. T. aluminium feeder on the Prussian States Railways at Dessau-Bitterfeld.

It may here be contended that the above results are obtained on figures unduly favorable to the cause of aluminium. There are, however, two sides to this argument, for the fluctuations in the prices of the various materials frequently bring aluminium into a decidedly more favorable light than in the instances outlined above. A recent illustration of this point is seen in the cable installed by the Metropolitan Electric Supply Company, Limited, London, in connection with the extension of their 600 volt feeder system. After careful consideration of all aspects of the case, a triple concentric paper insulated lead covered aluminium cable was decided upon, the segmental cores having an area of 0.83, 0.83 and 0.33 sq. in. respectively, a decision that resulted in a saving over copper of £345 per mile.

### Jointing Problems

The jointing of aluminium in the early days of its application to electrical work presented problems outside the experience of the general run of engineers; and results were not so consistently satisfactory as to meet the high standard of reliability required in electrical engineering. But while this fact has received wide publicity, it is not so generally known how completely the initial difficulties have been overcome in modern designs of joint for aluminium cable work.

### Jointing of Cables

While soldered joints have been adopted with more or less successful results upon one or two aluminium installations, experience goes to prove that suitably designed mechanical connectors meet more closely the requirements of the case, and satisfactorily withstand the test of time. Cast welded joints, being practically pure aluminium, are electrically perfect, but the intense heat renders it necessary to bare the conductor back to a considerable distance to avoid injury to the installation, and unless the workman has some skill in this line the whole process involves an unnecessary waste of time. On the whole, therefore, the jointing problem is best solved in the use of mechanical connectors.

These connectors are "stepped" in order to ensure that an intimate contact is evenly distributed between all layers of the conductor, a condition not otherwise easy to attain owing to the difficulty of squeezing out the film of impregnating oil. A rough machined surface in aluminium permits of an excellent contact between clamp and wires on the application of pressure. This type of joint is much in use in England, being a later modification of that designed by Mr. S. L. Pearce, Chief Engineer of the Electricity Department, Manchester Corporation. It is approximately cylindrical in cross section, and has been designed for minimum overall dimensions consistent with mechanical strength and electrical efficiency, to obviate the necessity for joint boxes larger than those commonly in use for copper cables.

A more adaptable type of connector for jointing sector cores takes the form of a sleeve connector, with numerous set screws which bed into the strand. This is a design that finds considerable favor on the Continent. It may be safely stated that if these joints are efficiently made in the first instance, the connectors firmly screwed up, and the box filled with compound to prevent access of moisture, they form permanently reliable units as free from trouble as any other individual member of the distribution network.

A system of jointing that, in view of its satisfactory operation in connection with overhead line work, would appear to promise well as applied to insulated cables is the compression joint. This type has been successfully developed in the States and Canada, and consists of a stout sleeve of aluminium bored out to receive the two ends of strand to be connected. The sleeve is then compressed at short intervals throughout its length by means of a small hydraulic press, and the joint thus formed is stated to be of lower electrical resistance and mechanically stronger than the cable.

Service leads, etc., may be tapped off by means of Tee connectors embracing only the outer layer of the strand, provided the length of connector as measured along the feeder is at least five times the diameter of the service lead. In connecting up copper services to aluminium distributor cables, clamps terminating in a flat contact should be arranged for wherever possible, and these should preferably be filed at right angles, and after firmly bolting together, should be painted or otherwise rendered moisture-proof in order to avoid galvanic action between the two metals.

Single wires may be quickly and efficiently butt welded in the flame of a blow lamp, the flame being given a reducing or deoxidising effect by restricting the amount of oxygen to rather below that required for complete combustion. The two wires to be joined are kept in a straight line, and a gentle pressure exerted when fusion commences, when the flame should be immediately withdrawn.

### Scrap Value

Provided the cost of producing an aluminium cable be placed upon an equal footing with the copper equivalent, it will be found in practice that the profit gained in the first instance capitalized over the usual life of a cable, say from 20 to 30 years, will more than meet any difference that may exist in the relative scrap rates of copper and aluminium. An illustration of this point may be seen on referring back to the L.T. cables instanced under "Economic Considerations." The net economy over copper on the  $7\frac{1}{2}$  miles of aluminium cable amounted to £1950, which at 4 per cent. over a period of 20 years—the minimum useful life of the cable—becomes £4285. To this sum must be added the value of some 25 tons of scrap lead in excess of that utilized in the copper equivalent, which at £17 per ton will be £425, or a total of £4710. The value of the copper scrap at £61 per ton would be £4220, and we therefore have £490 to the advantage of aluminium, even if the scrap value of this metal were nil.

As a matter of fact there is little difficulty in disposing



of aluminium scrap, either in this country or on the Continent, provided the history of the metal is known. It will be readily understood that it is essential that the highest standard of purity be maintained in metal for electrical work, and this fact naturally causes producers to hesitate in the purchase of scrap metal, when practically anything in the nature of white metal is referred to as aluminium.

There are certainly contingencies that arise in connection with collieries and similar enterprises, where a valuable cable may be laid for a comparatively short period. In such cases it is surely more a matter of salesmanship than of relative scrap price of the two metals, for a colliery owner would no more sell a 3-core armored cable as scrap aluminium or copper than he would sell a triple expansion engine as scrap iron. Here is a cable designed and guaranteed to transmit a certain load with a minimum of loss and depreciation, and a man in the market for such a second-hand length will be inclined to consider what it will do, rather than what it is made of. If, therefore, he knows that aluminium will not only do the work plus an additional overload capacity of 10 per cent., but will also be considerably lighter on supports in shaft and workings, it is rational to suppose that he will give a percentage of the initial outlay at least as high as would be obtained on the copper equivalent.

In the foregoing, the questions most frequently raised have been dealt with as briefly as possible. Other doubts may occur, but these are usually indicative of a natural clinging to the more familiar metal, rather than of any active prejudice militating against the development of aluminium. Such opposition as does arise is mainly traceable to copper interests, or to wire and cable manufacturers who can only perceive in aluminium a reduction in turnover, and the necessity of adapting their methods and standards to the more economical metal. But whatever the position aluminium is ultimately destined to take up with regard to insulated cable work, the present wide interest in the subject cannot be denied.

## Sterilizing Water by Electricity

Using the Ultra-Violet Rays of the Mercury-Vapor Quartz Lamp

By M. von Recklinghausen\*

Within the last five years a new field for the application of electricity has been created in Europe based upon the electrical production of ultra-violet light for the sterilization of water and for other purposes. As this new industry is now being introduced into this country, it is of interest at this time to analyze its basis and principles.

The experimental and development work in this field has been done mainly in France, and prominently identified with it are the names of Courmont, Nogier Henri, Helbronner, von Recklinghausen, Vallet and others. This paper deals particularly with the work done by the writer in collaboration with Messrs. Henri and Helbronner at the Physiological Laboratory of the Sorbonne University.

### The Source of Ultra-Violet Light

The only industrially-applied source of ultra-violet light is the mercury-vapor quartz lamp. The spectrum is known by its bright lines in the visible part and by a large number of typical lines in the ultra-violet part.

When starting this work we soon found that we had to go pretty fully into the question of the measure of the ultra-violet power of the different light sources at our disposal, so as to give the mercury quartz lamps the electrical characteristics which made them most useful for the creation of ultra-violet light. It is a well-known fact that the skin takes a less ghastly hue under the quartz mercury lamp than under

the ordinary mercury-vapor lamp. Spectroscopic examination shows that this is due to a considerable increase of the intensity of the red lines in the spectrum of the quartz lamp. This phenomenon was examined somewhat more closely, with the following results:

An ordinary 110-volt lamp was taken, which normally operates at 3.5 amperes and 80 volts; it was operated at different wattages, obtaining thereby, naturally, different temperatures of the mercury arc. A spectro-photometric analysis was made of the five principal colors, composing the visible light of these lamps. Assuming the intensity of each color at the lowest wattage as unity, we note that increasing the wattage of the lamp tends to increase the red more than the other colors. It might therefore be expected that the increase of the ultra-violet rays with increasing temperature of the lamp, would be somewhat like the increase at the violet end of the spectrum, that is to say, proportionately less than at the red end. As will be seen from what follows, this is not the case. There is obtained, on the contrary, a considerably greater increase in ultra-violet than in violet rays with increasing temperature of the lamp.

### Sterilizing Apparatus

The most efficient way for the mercury lamp to react upon water seems to be, a priori, to submerge the lamp entirely in the water which is to be sterilized. Direct contact, however, of the water with the heated lamp influences the luminous and ultra-violet efficiency of the quartz lamp to an enormous degree. It seems to be certain, therefore, that it is better, if one wants to plunge the light source into the water, to protect the lamp from direct contact with the water, and this system has been adopted with modern apparatus. This protection against direct contact can be secured by fusing over the lamp a wide quartz jacket which prevents contact of the light-giving portion of the lamp, with the water.

Difficulties, however, arose in the manufacture of such jacketed lamps and it was found advisable to construct the apparatus in such a way that the lamp was removable from the protective jacket, allowing, nevertheless, all the light to enter the water. Another method is to let the water circulate in such a way around the lamp that it would not come into contact with it, receiving nevertheless practically all the rays emitted by the lamp.

Where it is more a question of convenience and less a question of efficiency the simplest method is evidently to place the lamp above the water but as close as possible to its surface. Unfortunately, reflectors placed above such lamps have a low efficiency in reflection of ultra-violet rays. It may therefore be said that with such apparatus hardly half the rays of the lamp will enter into the water.

### Contact of the Rays with the Germs

Different germs have different sensibilities to the ultra-violet rays. The ones of greatest interest to us are the water bacteria and we find that they are killed in as short a time as 1/20 second, at a distance one to two centimeters from the powerful ultra-violet ray lamps. Water being practically as transparent as air to the ultra-violet rays, we are therefore certain that if a germ floats in the water it will be annihilated by getting into the illuminated zone, the condition for this being that no suspended matter is contained in the water which would form a shield for the germ.

Water for this sterilization has, therefore, in most cases to be filtered before being submitted to the sterilizing action of the rays. However, even very good filters will allow some microscopic matter to pass. It is much more effective, as shown by experiments, to stir up such water while it is going through the illuminated zone so as to turn over and over any particles which otherwise might allow microbes to pass by under cover. For the same reason, also, it is best to pass

\*Extracted from paper presented before A.I.E.E.



the water through several illuminated zones, which can easily be done by leading the water several times towards the same source of light, or by passing it successively under several sources of light.

#### Typical Installations

The largest unit ever built was set up about two years ago in the city of Luneville, France, to sterilize the city water supply. It consists of a flume into the sides of which ten 500-volt pistol lamp equipments are inserted. These equipments consist of metal boxes for the starting of the lamps (the latest types of them contain also the rheostats). The boxes are equipped on the inside with a stuffing box arrangement holding the quartz protective tube which protrudes into the water. The lamps are lit in the starting boxes and then their luminous parts are inserted into the protective tubes, so that the light emitted from the lamp enters the water.

The raw water fed into this plant comes from the Meurthe River and contains sometimes as high as 60,000 germs per cu. cm. It is clarified by a series of roughing filters and one filter. After this it is physically in fairly good condition, being very poor in suspended matter, but having from time to time fairly deep color (up to 45 U. S. standard) in solution. The germ contents are sometimes as high as 1,000 per cu. cm. in this water. It is then passed through the sterilizing unit described above, coming under the influence of the light from one to two minutes altogether, according to the number of lamps running. This number (sometimes only 4) depends on the physical condition of the water, which is easily observed. The bacteriological tests of the water when leaving the sterilizer rarely show more than 10 germs per cu. cm. and are often zero. Bacterium coli is always eliminated. Not only are the bacteriological tests satisfactory; the health of the community has improved considerably. Typhoid used to cause from 70 to 100 deaths annually; it is now practically eliminated, there being no cases at all this year.

Another typical installation was made in New York lately for the purification of the water of a swimming pool, which is naturally exposed to continuous pollution from the bathers. The water in this case is circulated continually through a filter to take out suspended matter and then it passes through the ultra-violet ray sterilizer. This apparatus is similar to the Luneville unit except for its size, as it contains only two 220-volt pistol lamps. It is rated at 175,000 gallons capacity per day. Tests at the outlet of the sterilizer show only a few germs, and tests of the water going to the purifying apparatus have improved from 6,000 germs per cu. c.m. to about 350 germs per cu. c.m. since the introduction of the ultra-violet ray apparatus.

#### Consumption of Electric Energy

The smallest lamp used in the above apparatus operates at 110 volts with two amperes. The largest made so far is for 500 volts, 2.5 amperes. The largest apparatus built contains ten of the last-mentioned lamps. The power consumption in such a case, with a very large safety coefficient for the sterilization, is between 50 and 130 kw.h. per million gallons of water. This amount of power is evidently not very great but it will always do something to smooth out the load curve of a power station, as, in most cases, such apparatus will be operated continuously. Many installations of this kind have been made in Europe for both small and large waterworks, and they are operating very successfully. Their simplicity and rapidity of action are highly satisfactory.

Returns of the May operations of the B. C. E. R. Co., just made public, showed that the number of passengers carried during that month was 3,370,943, as compared with 4,267,250 for the same month in 1913, a decrease of over 20 per cent.

## Touring by Electric Automobile

By J. S. Codman

Has the day of the electric touring car arrived? Or, if not, how far distant is it and what must yet be done to hasten its coming?

We cannot yet say that the day has come, but on the other hand it is now close at hand and the obstacles still in the way are neither many nor great.

Already the electric has ceased to be merely a town car. In addition, it is now the ideal runabout both for city and country work. It is more convenient, more dependable, more comfortable and cheaper to operate than a gas car, and within the last few years has been so developed that actual road runs of 70 to 100 miles have been made at a speed considerably greater than the usual road speed of the gas car. To prove this last point a list of various runs made in New England between different points has been published, and probably all New England men who are familiar with one or more of the roads, know about how fast a gas car can comfortably make the distances. All of these runs were made with stock cars and each one was on a single charge of battery.

As regards touring, the electric has sufficient speed, and two notable tours made within the year show also that rough, muddy, and hilly roads and bad weather are not real obstacles.

Last summer a tour of between 500 and 600 miles was made in an electric through the Green Mountains of Vermont and the White Mountains of New Hampshire, and no difficulty was experienced, either on the steep hills nor on the rough or sandy country roads. The distance from Boston to Burlington, Vt. (258 miles) was made at an average speed of 19 miles per hour. The route taken was through Fitchburg, Ashby, Jeffrey, Dublin, Marlboro, Keene, Walpole, Bellows Falls, Springfield, Walpole, Rutland, Brandon, Middlebury, New Haven, and Vergennes, and motorists who have been over this route will recognize that some parts of it present many difficulties. The slowest run was from Keene, N.H. to Springfield, Vt., 42 miles, 16.7 miles per hour and was made almost entirely after dark. The fastest section covered was from Boston to Fitchburg, 21.3 miles per hour. The 78 miles from Rutland to Burlington (including detours) was made at exactly 20 miles per hour.

An even more notable run was made last October from Boston to Chicago during the worst weather of the season which turned many of the roads into sloughs of almost impassable mud, but again no greater difficulty was experienced than might be expected with any car under such circumstances.

Some of the data of this trip is given below and especial attention is called to the high daily mileage and high average speed obtained whenever fair conditions of road and weather were encountered.

The car left Boston, October 14, arriving in New York the next day, where it was then exhibited for three days at the Electrical Show. It started for Chicago, October 19, and ran some part of every day with the exception of Sunday, October 26, when a rest was taken at Cleveland.

The minimum daily mileage was 18 between Albany and Schenectady, following the failure of the garage in Albany to properly charge the car; and the maximum daily mileage was 173.5 between Syracuse and Buffalo, where good roads and good weather were in combination. It will be seen that an average speed of 20 miles per hour was readily attained under fair conditions, while between Springfield and New Haven it was 23.6 and between Rochester and Buffalo, 22.8. The average speed for the whole distance is obtained by dividing the total miles, 1,302.5, by the total hours consumed



in running between points, viz., 33.5 hours. This gives an average speed of 15.6 miles per hour, which is certainly remarkable considering that no time at all is taken out for road stops.

The latest remarkable trip in an electric automobile was made in the early part of this month, and for the first time on record an electric automobile left Boston and arrived in New York in less than 24 hours.

If then, the electric automobile is not lacking in speed and is fully capable of meeting all road conditions, what then are the obstacles to its use for touring? As is evident everywhere, it is the difficulty in getting charged on the road. This difficulty, however, is not to any great extent a difficulty inherent in the car itself. It is true that a battery cannot be filled as quickly as a gasoline tank, but on the other hand, the delay is not great if proper facilities can be obtained. Boosting a battery at high current rates is perfectly practical to-day. The Edison battery is notable in this respect and even lead batteries, it is now understood, can be charged without injury at much higher rates than was formerly thought possible if only proper care is taken to reduce the rate before the gassing point is reached.

I have myself on one occasion out on the road boosted a battery at 200 amperes for one hour. This battery was composed of Edison A-6 cells rated at 45 amperes normal current and it absorbed in that hour enough charge to have carried me about 50 miles. On this occasion my cable was passed through the window of the electric light station and connected directly on the exciter bus and very little time was lost in getting connected.

The overcoming of this great obstacle to touring with an electric is something we must leave largely in the hands of our central friends. Generally speaking, they are most willing to help when an emergency arises, but this does very little real good. What is needed is apparatus all ready for use and someone about the premises who knows what ought to be done.

Now of course there are Central Stations which provide ample and convenient charging facilities but they are very exceptional. In most of the small towns and even in many large cities proper facilities for charging are either non-existent or are very inadequate.

Taking New England for example, Massachusetts is, as compared with the other states, well-equipped with charging facilities and yet what are the figures? McCraw's Central Station Directory reports over one hundred (114) electric light companies operating in over 300 of the 333 towns and cities in Massachusetts. On the other hand the list of charging stations compiled by the Electric Motor Car Club, after a canvass of all the garages and electric light companies, indicates only 53 towns in which the charging stations are supposed to be located, and only 28 towns where more than 50 amperes can be obtained.

It would certainly seem that where there is in a town no public charging station capable of giving an adequate boost, at least 100 amperes at 125 volts, the electric light company itself should have ready for use a service connected with the exciter bus. This service should consist of a switch, fuses and terminals for connecting to the cable and charging plug which every motorist should himself carry. A cheap resistance coil for controlling the current it would also be best to have ready, but often even this is unnecessary especially when the Edison battery is used. Measuring instruments are not necessary, as it is the service rather than the amount of current which should be charged for, and further an approximate measurement can usually be made by means of the instruments on the car itself. Such an outfit would be very inexpensive.

Now in the face of records of this kind, it is time for the central station man to do his part, and if he cannot ar-

range a neat little installation of battery-charging equipment by using his exciter for this service at a cost which is too small to consider he must be indeed lacking in enterprise. It ought not to be necessary for an electric automobilist to telephone ahead from a point several hours run away in order to secure the required charge on arrival. We are inclined to think that most central station men will go out of their way to accommodate the cross-country driver of an electric automobile in the particular rare instances when such a machine comes along; but what is really needed is a readiness-to-serve policy which will make the purchase of a charge as simple a matter as the buying of five or ten gallons of gasoline from the village grocery—a continuous availability of the charging apparatus at all hours and at a fair price. With the increase of day service even among the smallest central stations the time has passed for indifference or sluggishness in the matter of being ready to charge vehicle batteries at 2 a.m. as well as at 6 p.m. through simple home-made flexible connections and resistances whose cost is nominal. Of course, the electric automobiles will not come until the small central station is prepared to charge them; the latter must get into line and be ready for the business, and the ultimate profits are already clear to the far-sighted student of electric vehicle development.

**Table I.**  
**Runs Made by Various Electric Automobiles on One Charge of Battery**

	Miles	Time	Aver. Speed
Boston to Pawtucket, R.I., and return (78 miles) remainder of run about Boston . . . . .	103.2	5.075	20.14
Boston to Springfield . . . . .	93.4	4.55	19.00
New Haven to New York . . . . .	78.4	3.51	20.4
Rochester to Buffalo . . . . .	77.0	3.45	20.5
Brookline & Groton, Mass., and return . . . . .	74.0	4.01	18.4
Springfield, Mass., to New Haven, Ct. . . . .	66.1	2.48	23.6
Boston to Wareham, Mass. . . . .	58.0	2.47	20.8
Worcester, Mass., to Springfield, Mass. . . . .	51.7	2.08	24.2
Boston and Fall River . . . . .	49.9	2.37	19.1
Geneva, N.Y., to Rochester, N.Y. . . . .	46.0	2.01	22.8
Brookline & Amesbury, Mass., via Haverhill . . . . .	45.0	2.12	20.5
Boston and Worcester . . . . .	42.5	1.46	24.0
Boston to Lowell, Mass. . . . .	25.9	1.12	21.6
Springfield, Mass., to Hartford, Ct. . . . .	27.3	1.03	26.0
Brockton, Mass., to Boston . . . . .	21.8	1.05	20.2

**Table II.**  
**Boston to Chicago Tour in Electric Roadster**  
**Summary of Daily Mileage**

	Miles
Oct. 14—Boston to New Haven . . . . .	161.0
Oct. 15—New Haven to New York . . . . .	78.4
Oct. 19—New York to Albany . . . . .	150.3
Oct. 20—Albany to Schenectady . . . . .	18.0
Oct. 21—Schenectady to Syracuse . . . . .	129.8
Oct. 22—Syracuse to Buffalo . . . . .	173.5
Oct. 23—Buffalo to Erie . . . . .	104.3
Oct. 24—Erie to Ashtabula . . . . .	45.0
Oct. 25—Ashtabula to Cleveland . . . . .	59.6
Oct. 27—Cleveland to Fremont . . . . .	86.3
Oct. 28—Fremont to Wausem . . . . .	67.3
Oct. 29—Wausem to Kendallville . . . . .	64.6
Oct. 30—Kendallville to South Bend . . . . .	61.0
Oct. 31—South Bend to Chicago . . . . .	103.4
<b>Total . . . . .</b>	<b>1,305.5</b>



# The Question of Public Relations

By Thomas N. McCarter\*

The trouble with this street railway proposition is that most people do not know anything about it. If we who are versed in this business should undertake to tell them as much about their business as they with great nonchalance tell us about ours, they would quickly inform us that we were talking about things we knew nothing of. With what I say on this subject, I have no false modesty. I speak whereof I know, taught in the school of hard experience.

## A 3-cent Fare Inadequate

I start with the direct proposition that it is impossible, under present-day conditions, to operate an up-to-date street railway in this country, pay operating expenses and earn interest on the actual cost of the investment on a 3-cent fare. Why this demand for a 3-cent fare? Have the gentlemen who so clamor for such a fare worked it out scientifically? If I understand the principle of rate regulation at all, it is that electric railways, being quasi-public bodies, must be allowed to earn, in exchange for the franchise grants, only a fair return upon the value of the property devoted to the public use. Who has told these gentlemen that a 3-cent fare will do that? Why is it that they clamor so loudly for a 3-cent fare? Why do they not make it 2 cents or 1 cent? It is simply a will-o'-the-wisp, a happy catch word of the politicians.

While I accede entirely to the proposition that in the long run one catches more flies with molasses than with vinegar, and I am willing to go to the limit in endeavoring to placate even those whose intelligence I may not respect, I do not propose that the interests I have in hand shall be ridden over rough shod by the demagogues and the cheap politicians without a fight. I venture to say that of those in authority clamoring after this fare at the present moment, there is not a single man, in this city or elsewhere, who can tell you the basis of his belief, other than that the companies under discussion are public service corporations, that fortunes have been made out of those properties, perhaps improperly, in the past, and that, all things considered, 3 cents is enough for them. The whole 3-cent fare agitation is uneconomical and unsound, and as soon as the people of this country get that in their minds the better for everybody, including themselves.

The railway property of the Public Service Corporation of New Jersey has gross receipts of approximately \$16,000,000 a year. We furnish with transportation all of the larger cities of the State of New Jersey, with the exception of Trenton, and many of the smaller ones. We operate large city, suburban and interurban properties. We have a straight 5-cent fare with a very liberal transfer privilege, so that the county rather than the city is largely our 5-cent fare limit. To that extent we are liberal. Sixty per cent of a 5-cent fare is 3 cents. In 1908 our vast system was operated for 61.7 per cent of its gross receipts. In 1909 it was operated for 59.1 per cent of its gross receipts, in 1910 for 60 per cent, in 1911 for 62 per cent, in 1912 for 63.6 per cent, and in 1913 for 63 per cent. Where would we have been with a 3-cent fare? We would not have paid operating expenses, except in one year, when we would have had 0.9 per cent over.

Some one will say that the 3-cent fare will very largely increase the receipts because of the large increase in the riding habit over what it would be with a 5-cent fare. It is not so. We have just been through an experience of this character in our gas business. For many years our average increase in the output of gas has been 7 per cent. A year ago the Public Utilities Commission of New Jersey re-

duced the price of gas from \$1 to 90 cents per 1,000 ft. and they and the people of New Jersey said that we would more than make up the decrease in price through the increase in consumption. The first year, under the 90-cent gas rate, we increased a little over 6 per cent, or less than the 7 per cent average of the preceding ten years. The same result was demonstrated in the New York Consolidated Gas Company matter, where the price of gas was reduced from \$1 to 80 cents with absolutely no abnormal increase in consumption.

## Hazards of the Industry

We are at the parting of the ways with these industries in this country. I am not an apologist for the past.

I know money was made out of public utility properties in the early days, and that some things were done which would not be countenanced now. I am not so sure that they were wrong. You must remember the electric railway industry is only twenty-six or twenty-seven years old. I still adhere to the principle that a man who has the hardihood to venture his money in a new and untried art that develops and changes over night, is entitled to make a good profit, something more than interest on his money. If he were not entitled to such a profit, he would be a fool to go into the enterprise. It is easy when success is assured to begin to talk about cutting down the rate of return to something more nearly normal, but when you are talking about the industry that in only twenty-seven years has almost revolutionized transportation in the world, it is too soon to begin to cry "Wolf" and to attack the early investors because they have made money out of it.

When this country wanted a transcontinental railroad built, it held out very great inducements to the promoters who would build it. Among other things, the government gave thousands of acres of land along the line of the Union Pacific Railroad. After the Union Pacific became a success, it undertook to take the land back. Was that fair? Did not the men who had the hardihood to go into that enterprise have the right to keep this land? They did, and the United States Supreme Court said so. It is the same thing in this matter of ours. A few years ago some gentlemen had the hardihood to build tunnels under the Hudson River, connecting the States of New York and New Jersey. Nothing has ever been done that has been as great a boom to New Jersey as the making of these tunnels, but the venture has not been a success. The property has had to be readjusted, and the bonds which were issued only for investment have had to be scaled down, half being mortgage bonds and half being income bonds. The company is now earning interest on the mortgage bonds and hopes some day to earn interest on the others. Will anyone say that those gentlemen who had the temerity to put their money in the bowels of the Hudson River and connect the great States of New York and New Jersey by rapid transit, should, if their enterprise ever does prove successful, be limited to a 6 per cent return on their investment? If this is adopted as the policy of this country it certainly means to say that no such enterprise will be established, for no man will be fool enough to undertake the risk and hazard of such an extraordinary enterprise under such conditions.

Would any of you take a franchise to-day for air-ship work and put your money into it? Would any of you back an enterprise that had transportation between here and Detroit by air for its object? It is not any more unlikely, thirty or forty years hence, that there will be such a means of locomotion between here and Detroit than it was thirty

\* President Public Service Corporation, Newark, N.J.



years ago that street railways would be what they are to-day. If you and I had the hardihood to back an enterprise of this kind and we waited until the people began to use it, would we not be entitled to more than 6 per cent. on our investment?

#### Fair Return for Established Property

After a property has become established, as ours is at present, though not firmly, a different problem presents itself. There should be no extraordinary or improper return, but the return should always be substantial and above the legal rate of interest. Otherwise I, for one, who have some idea of the annoyance and responsibility of this work, would leave my money in a savings bank or take a mortgage on real estate, and leave the troubles of this business for someone else. What is a fair return on the hazards of the business? I cannot say, but I know it must be sufficient to attract capital. It must be sufficient to keep the property developed up to the needs of the city, and, by and large, it should never be less than 8 per cent. on the value of the property devoted to the public use. Otherwise capital will flow elsewhere into different channels with less hazard. Any community that seeks to pare down the return below this point hurts not only the traction company but more especially itself.

When I was president of the American Electric Railway Association, I went from one end of the country to the other making speeches. The great value of this was that I saw how the different properties were operated and how they were developing the cities of the country, and I say without fear of contradiction, no one other single element that has arisen in the last twenty-five years has so developed the American city as have the electric railways of this country. And they will go on developing this country if they are allowed to. Just think how they have revolutionized the lives of the people of the cities. Just think how they have made it possible for men of moderate means to live in the suburbs and to own their own homes instead of living in congested centres in tenements. All has been done with a maximum of a nickel fare, throughout the length and breadth of this land, and yet the cry goes up that we are robbing the poor people and robbing the country, when as a matter of fact we have not only done this development work but have also created untold amounts of wealth for the individual property owners, and also for the cities themselves through the medium of the increase in tax values. It is such a mistaken point of view for municipalities to try to draw the last drop of blood and insist upon the last pound of flesh. How much better it would be, instead of the turmoil that is in Toledo at the present time, to have a company allowed to go on in its own way, regulated, with rates so that the return would be commensurate with the service rendered, but so that the company could get the necessary capital to develop the city. How much better would every individual be if that were the case, instead of having the present condition prolonged to an indefinite future, with a saving once or twice a day of some portion of a cent.

#### Results of 5-cent Fare in New Jersey

I said we had in New Jersey 5-cent fares. So we have, but by the operation of the transfer system it is reduced, as far as the fare per ride goes, to 3.8 or 3.75 cents. That is the fare that every passenger who boards a car, whether for a cash ride or a transfer ride, pays us. A 5-cent fare, or this 3.8-cent fare, enables us to pay our operating expenses, pay a reasonable return upon the investment of capital, and, what is more important, obtain the necessary new capital for further development. In the eleven or twelve years of my administration, there has been invested between \$30,000,000 and \$40,000,000 in the development of the railway property alone. Under present conditions in To-

ledo, how long will it be before that sum of money is invested here?

Only yesterday I had the great privilege in the city of Newark of turning the first operation of a steam shovel on a new electric railway terminal which we are about to construct for the purpose of taking our cars off the congested centers of the streets. We approach this terminal along the one side by a subway a quarter of a mile long, and on the other side by an elevated line a quarter of a mile long. On the ground floor of this building will be a great concourse, like that of the Hudson Terminal, one flight down to the subway and one flight up to the elevated. When the terminal is done, we shall be able to double the cars now in use, and we hope to increase our business very materially. It will cost more than \$5,000,000. We had no trouble to get the money because of the condition I have spoken of, but if you needed such a terminal in Toledo at this time, you would have a nice time getting any \$5,000,000.

The answer to the whole proposition is that while there are peculiarities about this business, it is like every other business; it is governed by inexorable economic laws, which no amount of skullduggery or tomfoolery or political nonsense can overcome. Some people say I am blunt and tactless at times and undiplomatic. I am all through with trying to soft soap these things to a successful issue. I propose, for one, hereafter to stand up and be counted and let the people of any community in which I am interested know just what they are doing, not only to me, but to themselves.

#### The Franchise Question

I know it is hopeless for me to attempt to change the attitude of the Middle West, or perhaps the rest of the country, on the question of short term franchises, but I also know that the principle of short term franchise is all wrong. It is uneconomical and unsound. I do not argue for the old fashioned, unregulated, perpetual franchise, which allows properties to be exploited by a few men for the benefit of themselves. Now that regulation has come to stay, as it has in this country, these things are a thing of the past. The question of the length of franchise, from the standpoint of the municipality, is relatively unimportant, whereas to the company itself it is of vital importance. Some say a twenty year franchise is long enough, and they ask you to make a large capital investment or to retain your present capital investment, with a twenty year franchise, and let the future take care of itself. Suppose any of you leased a piece of property on any of these main streets, where the property values are high, for ten years, and only for that period, and you went ahead and put a large mercantile building upon it, costing \$100,000. Would not any reasonably prudent man, if he had only a ten or twenty year lease on that property, charge off one-tenth or one-twentieth of the value of his property as he went along? If these short term franchises are to be granted without any hope in them beyond the limit of the day to which they are granted, then I say it is the duty of the company to amortize its investment. In such a case, who must pay for the amortization? The people who ride on the car. It becomes an operating expense, or a fixed charge, an expense akin to an operating expense. In other words, it is a short-sighted policy on the part of the municipalities to insist on short term franchises unless they want to put an undue burden on the present generation. The length of a franchise period becomes immaterial when it is assumed that there is a commission that will enforce good service and reasonable rates. These constantly recurring periods, such as occurred a few years ago in Chicago and Cleveland, and such as is now going on in Toledo and is about to burst wide open in Detroit, hurt the community. If this franchise question did not come to a head with such periodic frequency, but went on either indefinitely, or so that the amortization would be spread over a long period of years and not fall so heavily upon the present generation, it would be better for all concerned.



# Maximum Demand Determination

## And Its Relation to the Cost of Supply of Electrical Energy

By P. T. Davies, before the C.E.A. Convention

In the sale of power developed from hydro-electric plants, a short study will usually show that the basis of sale should be on a demand basis, and that the use of the demand has little effect on the cost of production.

Under present conditions it is found that the maximum demand of an individual consumer is the most important feature from the standpoint of cost of supply—the use of the demand only affecting the diversity factor of the supply system.

Diversity factor, which is the *raison d'être* of the present day supply plant, is, however, a matter which should be considered in determining a demand, and the only method by which this can be taken into account is by choosing the method of determination with due regard to the possibility of coincidence of demand.

Before proceeding to discuss the question of determination, it should be noted that the question of maximum demand is of equal importance in the operation of a steam plant as in the case of a hydraulic plant, and it is becoming more generally the practice to make rates for power supplied from steam-generated supply stations of such a nature that a definite return per horse-power of maximum demand is guaranteed. In this connection it is interesting to peruse the report to the Committee on 'Gas, Oil and Electric Light,' on the investigation of the Commonwealth Edison Company.

The following illustrative figures have been extracted from this report in order to show the small part which the actual production costs bear to the total cost of supplying electrical power. These figures have been chosen with particular regard to the railway and bulk supply customers, who have, naturally, very much better load factor\* than the rest of the customers and whose use of maximum demand and, therefore, operating cost per horse-power would be materially higher than that which would be apportioned to the average customer.

These figures show as follows:—Year 1911: 443,428,100 kilowatt hours sold for bulk supply. Production costs \$1,579,712, of which, however, \$213,759 does not depend upon kilowatt hour use, making \$1,365,953 which can be traced to production costs, pure and simple. Transmission, commercial, general, and miscellaneous expense, \$716,105.

In 1911 the kilowatt hours sold for lighting amounts to about 130,000,000, for power about 75,000,000, and for railway load 445,000,000. At the same time the connected loads show 190,000 kw. for lighting, 120,000 kw. for power, and 110,000 kw. for railway load, making a total railway and power load of 230,000 kw.

It will generally be admitted that the maximum demand of the railway and power load will be a higher proportion of the connected load than that of the lighting, and if we take the maximum demand of 40 per cent on the connected load for lighting, we will be taking a very liberal figure—40 per cent of 190,000 = 76,000 kw., which, deducted from the maximum load of 199,000 kw., the maximum load of the system, gives us a power load of 123,000 kw., or 62 per cent of the total load.

If we apportion 62 per cent of the fixed charges, including depreciation, to the power load, we shall not be putting on too heavy a charge, in view of the fact that approximately 80 per cent of the kilowatt hours sold are sold for railway and power use. While the report does not show the amount set aside for depreciation, we have, however, the following figures:—

Table No. 4—Expense including Depreciation \$10,647,052.00  
Table No. 10—Expense excluding Depreciation 7,007,980.00

Difference = Depreciation	\$ 3,639,072.00
Interest	1,563,774.00
Dividends	2,221,474.00

Total Fixed Charges	\$ 7,424,320.00
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62 per cent of this	\$ 4,603,078.00
Add General Expense—62 per cent. of \$716,105	443,985.10
As above, operating expenses were shown to be	1,365,953.00

Giving a total of \$ 6,413,016.10  
Of which the fixed charges are 78.5 per cent., showing that on a steam-driven plant with a very high load factor the fixed charges are far and away the most important item in the cost of supplying the energy.

In order to investigate the proportion which the fixed charges bear to the operating charges in a hydraulic plant, the following figures have been taken as representative of a moderate sized hydro-electric development of medium head, operating at a distance of 30 miles from a main market for power:—

	Capital Cost per H.P.	Depre- ciation \$ per H.P.	Interest at 5% \$ per H.P.
Cost of Hydraulic Development, including Dams and Power House, per h.p.	\$70.00	2.10	3.50
Water Wheels and Electric Generating Plant, including Switchboard	30.00	3.00	1.50
Step-up and Step-down Transformers and necessary Oil Switches	5.00	.25	.25
Transmission Lines, including Right-of-way	15.00	.90	.75
Receiving Station	5.00	.25	.25
Switchboards for Local Distribution and Wiring	1.00	.05	.05
Regulators for Local Distribution and Wiring	3.50	.35	.17½
Cost of Service taken at an Average Distance of Two Miles from Receiving Station	10.00	.80	.50
Customers' Transformers and Individual Services	4.00	.40	.20
Totals	\$143.50	\$8.10	\$7.17½
Interest at 5 per cent on Capital Cost of \$143.50 per h.p.			\$7.17
Depreciation per h.p.			8.10
Taxes and Incidental Fixed Charges on Meters, etc.			.50

Total Annual Fixed Charges per h.p. Installed .. \$15.77

The actual operating charges on a medium-sized plant taken over a period of a year, taking into consideration a 25 per cent. steam reserve, runs as in Table 1.

Now, it is very obvious that few of the above operating charges themselves are affected by the running or not of the plant, and if we apportion 50 per cent to fixed charges and 50 per cent to running, we get

A total fixed charge of	\$18.97 per h.p.
And a running charge of	3.21 per h.p.



Table I  
MANUFACTURER.

Wages of P. H. Employees .....	}	\$3.20 per h.p.
Generating and Distributing:		
Oil and Waste .....		
Ice Expense .....		
Heating and Lighting .....		
Sundries .....		
Flashboards .....		
Steam Power Plant:		
Fuel .....		
Wages .....		
Oil and Waste .....		
Water .....		
Ash Handling .....		
Distribution:	}	\$0.53 per h.p.
Poles and Lines .....		
Inspection and Testing .....		
Pole Rental .....		
Fire Patrol .....		
Moving Poles .....		
Labor on Connections .....		
Testing Meters .....		
Changing Transformers .....		
MAINTENANCE.		
Power House:	}	
Buildings .....		
Dams .....		
Crane .....		
Water Wheels and Equipment .....		
Dynamos .....		
Electrical Equipment .....		
Transmission Lines .....		
Crane .....		
Cables .....		
Conduits .....		
Distributing Stations: .....	}	\$2.68 per h.p.
Crane .....		
Transformers .....		
Elec. Machinery .....		
Steam Station	}	
Engines .....		
Boilers .....		
Belts .....		
Pumps, etc. ....		
City Distribution:	}	
Poles and Lines—Subways and Conduits,		
Meters, Transformers, Tools and		
Machinery .....		
Total .....		\$6.41 per h.p.

Or fixed charges = 86 per cent. of total expense.

Now, if the fixed charges are the basis of the expense of operating the plant, what factor in the use of power by a customer is the one which affects the proportion of the fixed charge which should be borne by such customer? Without doubt, it is primarily the amount of plant, transmission line, receiving station capacity and city lines capacity which is required for the supply of power to the consumer which cannot be used at the same time for the supply to other customers.

Diversity factor or the non-coincidence of consumer's demand is, as previously stated, the reason for the existence of power supply stations, as even the decreased capital cost of large units compared with small units, the decreased operating and engineering costs following the handling of large amounts of power, together with the fact that very best engineering talent can only be supported by the large plant, would not overcome the cost of running an individual plant

which requires no transmission line or costly water-power development were it not for the fact that non-coincidence of consumer's demands enables the large plant to supply from one and a half to three times the sum of the individual demand of the consumer, whereas the individual plant must install sufficient capacity to take care of its maximum load.

In the determination of demand there are three methods at present in use, as follows:—

(1) Demand based on instantaneous peak.

(2) Demand based on lowest point of usage, during a stated interval.

(3) Average load during stated interval.

The first basis is, without doubt, a hardship on the consumer, and its use creates an apparently low schedule of rates for the attraction of consumers, which, however, only means that the consumer is billed on a high load at a low rate instead of at a good average load at a medium rate. Even if the price is kept at a reasonably low rate, the possibilities of instantaneous demands are always present, and, furthermore, an instantaneous demand is not necessarily a fair criterion of the amount of investment necessary to serve a customer.

The second method, although used in one or two instances, cannot be regarded as being a solution of the determination of maximum demand, as it is open to abuse—thus, a customer who may be paying upon the lowest usage during the highest 15-minute period per month, may have operations in his plant which are intermittent and do not last fifteen minutes. Furthermore, by prearranged methods it would be quite possible to arrange to defeat the ends of the contract by arranging to open the switch at any time when there is a possibility of a new 15-minute maximum being registered.

The third method is the one which is usually used, and it is the means used to obtain the demand by this method which will bear inquiry.

There are three points which it is intended to discuss:—

(1) Length of demand period.

(2) Number of demands to be taken.

(3) Whether a demand, once established, shall remain the billing basis for the balance of the contract unless exceeded.

A hydraulic plant has normally no overload capacity, while it is true that the possible output may vary from day to day and even during the day, and, further, that water storage may be available and be used in such a manner that the load factor of the plant can coincide with the load factor of the system and water be conserved; nevertheless, the output of water wheels has a definite limit, and it cannot be overloaded in the same manner as a steam plant.

In order to obtain, however, a basis of working, it is necessary to assume that a short period of overload can be absorbed under normal operating conditions, and this period has been taken as two minutes.

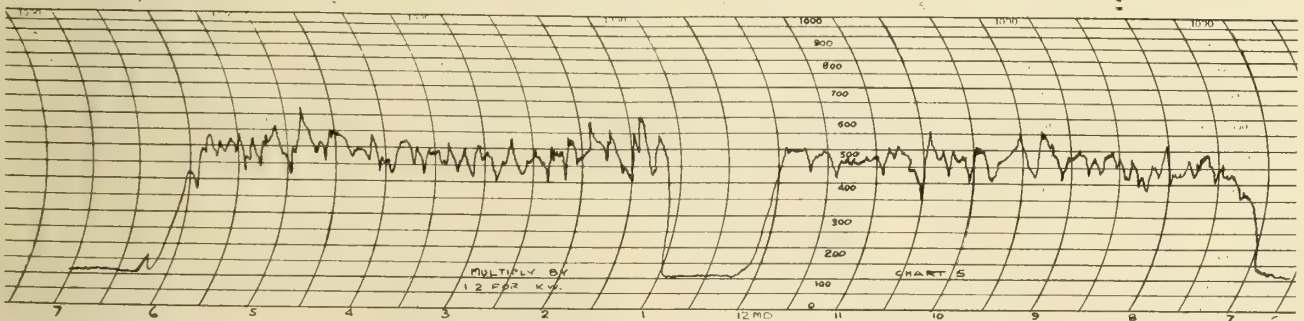
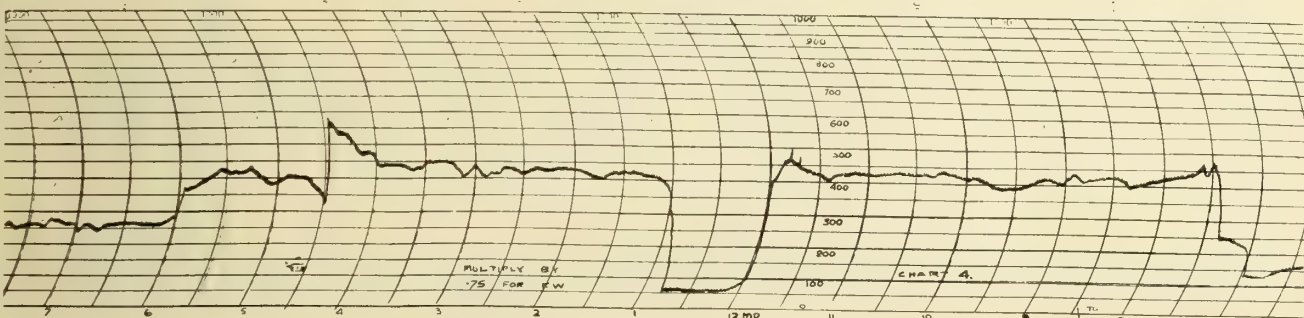
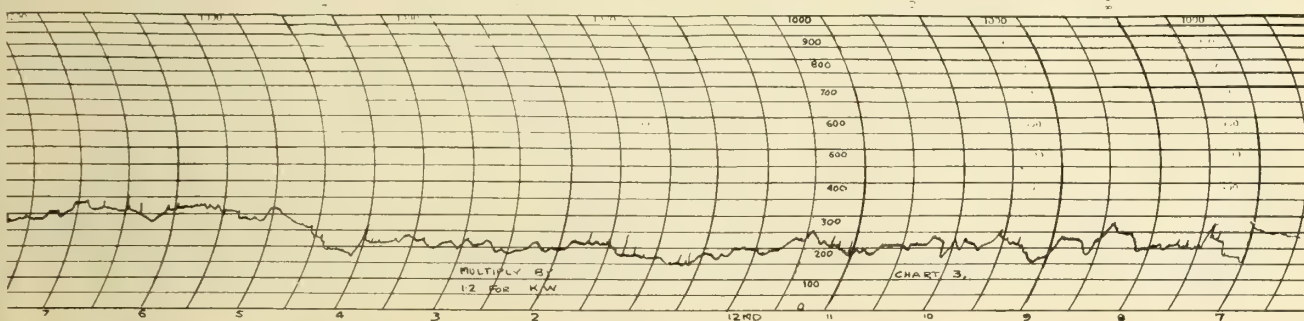
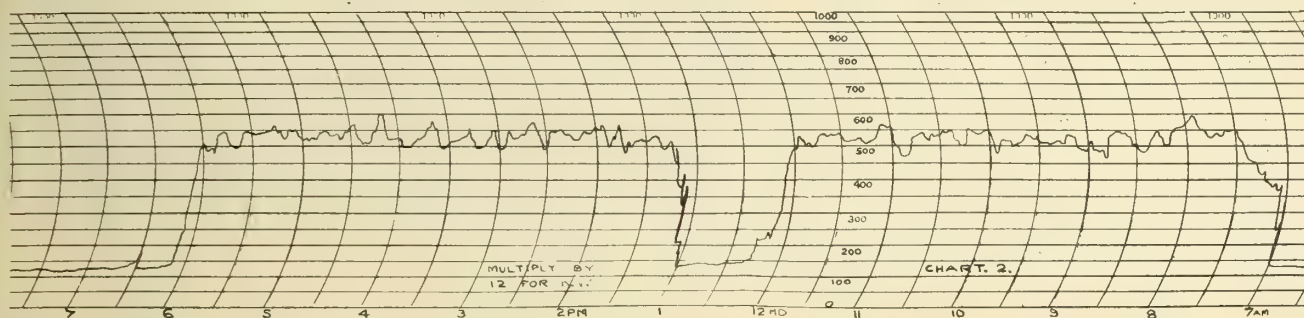
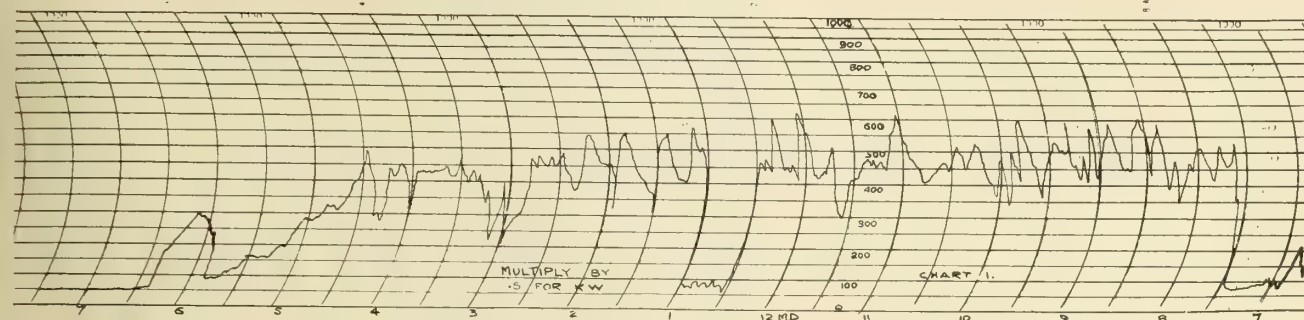
In view of the fact that we can allow very little margin of overload on the generating plant, it is obvious that the length of the demand period must be chosen so that the possibility of coincidence of demands has a fair factor of safety in favor of the supply station.

The time of day when power loads reach their maxima is generally from 7 a.m. to mid-day and from 1 p.m. to 5 p.m. The figure of 5 p.m. may be questioned, but experience shows that nearly all industrial establishments show a drop in load after 5 p.m., due, no doubt, to the natural disinclination of workmen to start any fresh operation after this time, and also the prolonged preparation for home going is more the rule than the exception.

This gives us nine hours per day during which peak loads may coincide.

It will be conceded that a demand of less than five min-





Charts 1, 2, 3, 4 and 5



utes would be a hardship on any industrial establishment if taken as the billing basis for a month or more, and we may take a five-minute maximum average demand as the minimum period of time which could be considered reasonable.

The chances of two equal 5-minute peaks overlapping for two minutes in nine hours is 67.5 to 1.

The chances of two 10-minute peaks overlapping two minutes in nine hours is 30 to 1.

The chances of two 15-minute peaks overlapping two minutes in nine hours is 19.3 to 1.

The chances of two 20-minute peaks overlapping two minutes in nine hours is 14.2 to 1.

We have, however, 30 days during each month upon which equal daily demands on two systems may coincide, and this reduces the chances to the following:—

Two 5-min. peaks coinciding two mins. 2.25 to 1 against.

Two 10-min. peaks coinciding two mins. 1. to 1 against.

Two 15-min. peaks coinciding two mins. .643 to 1 against.

Two 20-min. peaks coinciding two mins. .44 to 1 against.

If we now consider a larger number of peaks than one, we obtain the following comparison:—

Two 5-minute peaks on each of two customers coinciding two minutes ... 1.15 to 1

Compare one 10-minute peak on each of two customers ... 1 to 1

Three 5-minute peaks on each of two customers coinciding three minutes ... .75 to 1

Compare one 15-minute peak on each of two customers ... .643 to 1

Four 5-minute peaks on each of two customers coinciding two minutes ... .55 to 1

Compare one 20-minute peak on each of two customers ... .474 to 1

Compare two 10-minute peaks on each of two customers ... .5 to 1

These figures show mathematically that, presuming similar peaks occur each day, the chances of several five-minute peaks coinciding are less than the chances of prolonged demands equal in duration to the sum of the five-minute peaks coinciding.

The mathematical calculation of the possibility of coincidence offers a field that a short paper cannot investigate,

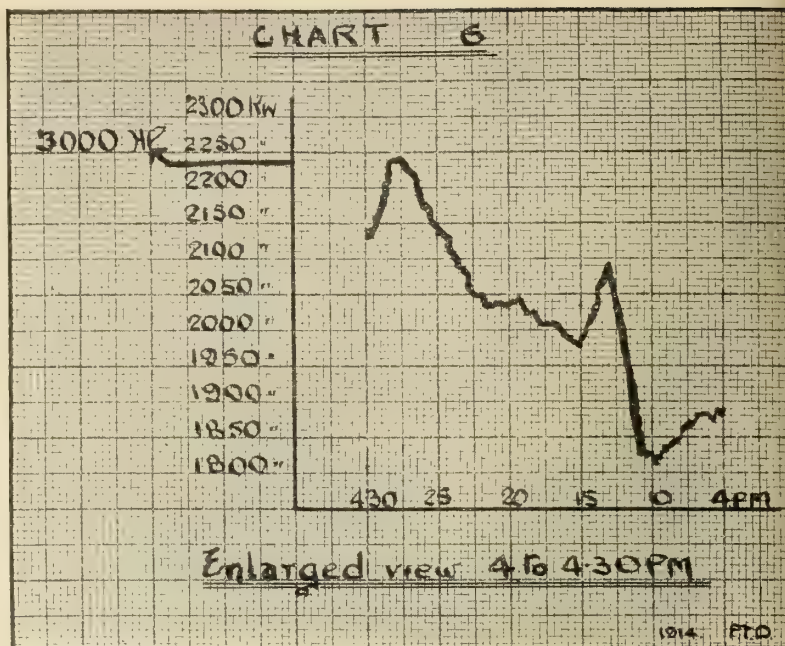


Chart 6.

charts chosen offer a comparison, and further work can be done when better charts are available.

The five charts have also been combined into a totality curve, giving the diversity factor of the system, and offering a basis for the determination of the effect of the individual peak on the cost of supply.

#### PEAK LOADS

	One 5 min.	Two 5 min.	Three 5 min.	Four 5 min.	One 10 min.	Two 10 min.	One 15 min.	One 20 min.
Chart 1 ...	326	323	319	314	310	306	298	291
Chart 2 ...	940	932	924	920	916	910	902	900
Chart 3 ...	530	525	522	520	520	515	515	510
Chart 4 ...	560	540	530	520	540	520	530	520
Chart 5 ...	950	926	907	895	870	860	840	835

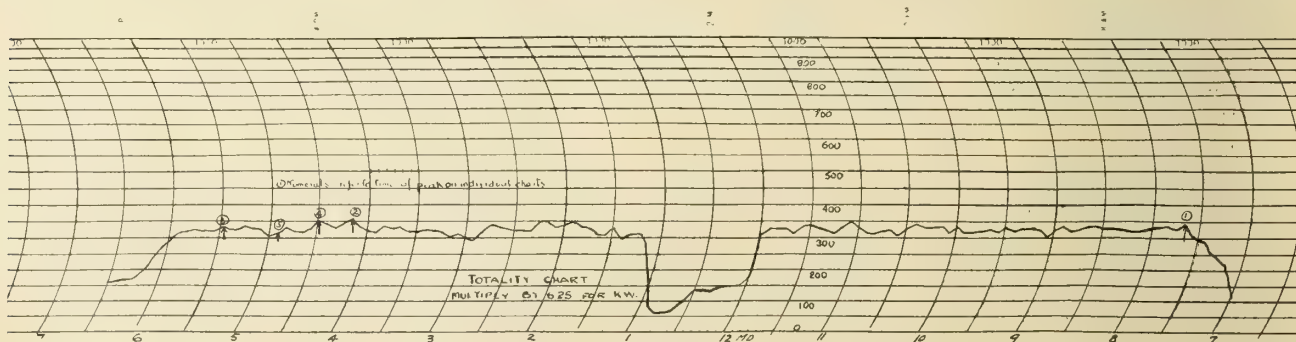
Sum ... 3,306 3,246 3,202 3,169 3,156 3,111 3,085 3,056

Figures from

totality chart 3,940 2,880 2,830 2,800 2,880 2,800 2,830 2,800

Max. 2-min. peak equals 3,000 h.p. on totality chart.

While the totality chart may be one or two per cent.



Totality Chart.

and, in order to check conditions as obtaining, a random choice has been made of a number of graphic charts on industrial concerns, which occurred upon the same day—December 5th, 1913—and demands determined from them as shown on following pages.

It is unfortunate that charts having lower load factor and more pronounced peaks were not available, but the

out at different points of the load, owing to the fact that the curves were taken from instruments that used paper with curved ordinates, special care has been taken to determine accurate results during the maximum loads, which appear as above for the totality chart and have been separately calculated from Chart 6.

These figures bear out the mathematical calculation



closely, and show nearly the same coincidence as was calculated above.

A point of interest is that the maximum 2-minute peak is only 56 h.p. short of the total of the 20-minute average peaks, thereby showing that there is little margin of safety in using 20-minute peaks as a basis of billing and little diversity factor between 20-minute demands.

In view of these results, the figure of the average of the two highest 5-minute average loads taken in the same day is suggested as a billing basis for any month.

Chart 6 is an enlarged view of the combined load between 4 and 4.30 in order to determine same as closely as possible.

The last question, as to whether a load, once established, shall remain the billing basis, is an interesting and debatable one. In making a rate for a particular demand, the investment necessary to serve that demand only is a factor which must be valued. Such investment depends upon the capacity of lines, apparatus, etc., which must be purchased, and these, again, depend upon the allowable margin of drop in voltage and overload capacity of transformers which is permissible.

The margin in voltage drop is decided by the fact that the choice of wire which can be used allows only a broad factor to be obtained.

The sizes of wire vary from each other by 20 to 25 per cent, and it is, therefore, evident that we can allow a 20 per cent variation of maximum demand without requiring more line capacity. Similarly, transformers are not generally obtainable in sizes varying from one another by less than from 15 to 20 per cent, and although there is a variation in the cost per kilowatt for transformers depending on the size, this variation would not have much effect within a 20 per cent limit. It is evident, therefore, that for the investment required to serve a customer as regards city equipment a 20 per cent variable is allowable, because this is the nearest choice that can be made.

With regard to the permissible variation allowable in generating plant and transmission line, it will be found that almost the same factor will apply—the transmission line again can only be chosen within the limit of standard gauge.

The variable in plant unit compared with total plant installed in six supply plants serving a large electric system in Eastern Canada is as follows:—

Plant No. 1	8 units
Plant No. 2	12 units
Plant No. 3	3 units
Plant No. 4	5 units
Plant No. 5	3 units
Plant No. 6	12 units

Total ... 43 units

Average unit per plant 7—variable 14 per cent in plant unit.

It must be borne in mind, however, that the hydraulic development has to be almost wholly completed even if all units are not installed, and, therefore, the variable is only on the machinery and equipment, and not on dams and cost of property, water rights, etc.

Taking this into account, we get the total value of plant variable as follows:—

#### FIXED CHARGES

Consumer's Service	20% of \$1.30 = \$0.26
Transmission Line and Transformer	20% of 2.15 = .43
Generating Plant	14% of 4.50 = .63
Development, say	5% of 5.60 = .28
	<hr/> \$1.60

Or, approximately, 10% of \$15.77.

This figure of 10 per cent is suggested as the amount of variation which should be allowed from any established demand. Of course, individual plants differ considerably, and the best size of generating unit to install is a matter that has to be determined for each plant itself.

In conclusion, it should be stated that this paper has been particularly written with the idea of obtaining discussion on the various questions involved, as it is a consummation very much to be desired that a standard method of determining maximum demand and applying same be arrived at which will be fair to the consumer and be an adequate protection to the supply company.

# Interruptions on L. D. Transmission Lines

## Their Origin and Best Methods of Prevention

By P. Ackerman, before the C. E. A. Convention

Long distance transmission of, electrical energy has within the last decade, undergone marvellous changes both in the applied voltage and the distance of transmission. In the rapid development higher voltages have been chosen for the new systems and we now have systems with 150,000 volt operating voltage and transmission distances of 250 miles.

With the application of higher voltages, new operating difficulties have been experienced which are due, not only to the higher voltage, but also to the larger generating capacity existing in such high voltage systems. Progressive though the engineer has been in adopting higher voltages, yet the progress has been slow in regard to improving the reliability of operation of these systems. It is only within the last few years that the important possibilities for improvement have been realized. Now, however, strenuous efforts are being made to bring the reliability of long distance transmission to the standard of reliability of the important low voltage systems.

The object of this paper is to define the troubles affecting the operation of a transmission line and their causes, and to

describe some of the problems relating to improving unfortunate factors of high voltage transmission.

The chief troubles, their cause and effect, on the operation of a transmission line under our climatic conditions, can be gathered approximately as follows:—

(1) **Lightning Troubles** form about 80/90 per cent of the total number of interruptions on a transmission system. The result of lightning interference is either a puncturing of an insulator, in which case a lengthy interruption generally follows if no spare line is available; or a flash-over, in which case the insulator may be seriously damaged by the power arc.

(2) **Sleet and Wind** cause troubles from wires getting within striking distance of each other, thus causing short circuits and total interruptions. Generally no damage is done to the cables and in this case only a momentary interruption will occur. However, occasionally the power arc may burn off the wires or cables, in the latter case causing an interruption of several hours if no spare lines are available.

(3) **Birds and Other Outside Interferences**, such as



wires being thrown against transmission wires, etc., generally cause a momentary interruption without damage to the line.

(4) **Unexpected Insulator Failures**, due to puncture of insulators without apparent cause, are usually due to the observed weakening of insulators after having been in service for some time.

(5) **Short Circuits in Distributing System** sometimes cause a momentary interruption to the transmission system but without any further damage to it. This is invariably due to a non-selective straight overload protection.

The means of eliminating the troubles causing these interruptions must be sought along two general lines.

(1) Improvements of the insulators must be made to prevent any possible puncture destruction or destruction by power arc and to eliminate the observed weakening of insulators on the line.

If these weaknesses are overcome the interruptions from insulator failures mentioned in item (4) of the list will be entirely eliminated, and the durations of interruptions from lightning (item 1) will be greatly reduced and with certain devices to be described later may be prevented.

(2) Improvements on relays and relay layouts must be made to obtain such selective action that the faulty part of the system is cut out without causing a total interruption. This is necessary in case of troubles from sleet and wind, outside interferences or short circuits in the distributing system.

These two problems will be discussed more in detail in the succeeding pages.

#### Improvements in Insulators

It has been shown that lightning causes the most trouble to a transmission line and that the insulator must be considered the weakest spot. Quite often a single defective insulator will put a line out of service for several hours.

These facts have been known for a long time and a great deal of investigation work has been carried on during the past few years to clear up many of the mysteries surrounding insulator failures, and although their design has been improved and many devices for protection against power arc destruction have been proposed, there has been very little improvement in the insulator body itself.

Some may be more fortunate than others, but there is probably not an operator of a high voltage transmission line who could not tell of insulators punctured during lightning storms, or failing quite unexpectedly with no apparent reason.

It has been stated that the insulator can be damaged from lightning either by puncture through the porcelain or by the power arc flashing over the insulator. A lightning discharge near the transmission line creates an excessive over-voltage of steep wave-front or high frequency. The excessive voltage is very often higher than the voltage the line insulator withstands and the result will be the breakdown of the insulator nearest the lightning discharge, the over-voltage thus finding release to ground. If one phase in a grounded system or two phases in an ungrounded system break down simultaneously, then a short circuit is produced between phases and an excess current will flow across the insulators which arced to ground and normally a total interruption is required to extinguish the arc across these insulators.

If the insulator requires a considerably lower voltage to flash-over through air than it takes to puncture straight through the smallest thickness of porcelain existing between live wire and pin, the lightning surge will flash around the insulator with the dynamic current of the system following and forming a heavy arc. If, however, the voltage required to puncture through the porcelain is smaller or about equal

to the flash-over voltage, then puncture will occur—that is, a small hole will be pierced through the porcelain from live wire to pin and the power current will flow through and will generally destroy the insulator. Puncture of an insulator is the most serious condition, as it will put the line out until the fault has been located and the insulator replaced, which frequently requires several hours.

#### Danger of Cable Burn-Off

In designs where the line wire is directly supported on a porcelain head and where such head may have a tendency to puncture, the situation is aggravated by the danger that the cable may be burnt off. Some observations and tests made by the writer may be mentioned to show the seriousness of this condition.

On an ungrounded system a ground on one phase was noticed. About two minutes later the line was cut out, no short circuit had occurred. Upon inspection a line wire was found burnt off and the insulator head was found to have a puncture hole right in the saddle where the line wire was resting. It seemed at first hardly believable that the charging current of 6 amperes of the line wire to ground could have burned a 4/0 line cable through within approximately two minutes; however, since no other explanation could be found, it was decided to demonstrate this action by a test.

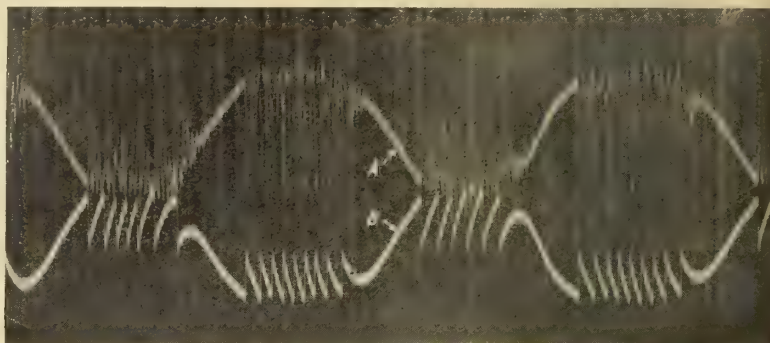


Fig. 1—Oscillogram on a testing transformer, showing discharge over insulator of 95,000 V. flash-over.  
A—High tension voltage. B—Low tension voltage.

A punctured head was obtained and a line wire seated above the punctured hole. A 12,000-volt generator with a water rheostat in series with the puncture hole of the disc was adjusted to about 80 ampere current flow, this being the lowest possible adjustment. The discharge through the puncture hole had to be started by a thin fuse wire pushed through the puncture hole. With this adjustment the oil switch of the generator was closed in, starting the 80 ampere discharge through the puncture hole. Instantly a concentrated flame shot out of the puncture hole and within three seconds the 4/0 cable was burned in two.

Comparing the test result with the observed action on the line it will be noticed that in the test a current about 13 times larger than in the case of the ground on the line did the same destruction within about one-fortieth of the time and, therefore, the test may be considered a satisfactory explanation. The effect is evidently due to great concentration of energy at the point of puncture, since it must be understood that any puncture hole will, the instant when formed, be smaller than a needle hole and thus concentrate the whole discharge at this point.

It will now be understood why in case of an actual short circuit on a line, where not only 6 amperes, but possibly several thousand amperes may pass through the small puncture hole, the momentary destruction is enormous, and it may be easily understood that in such cases the punctured insulators or discs may actually burst apart and line cables seating on them burn off notwithstanding the fact that there may be instantaneous relay action. From this it may be concluded that line wires should not be supported directly

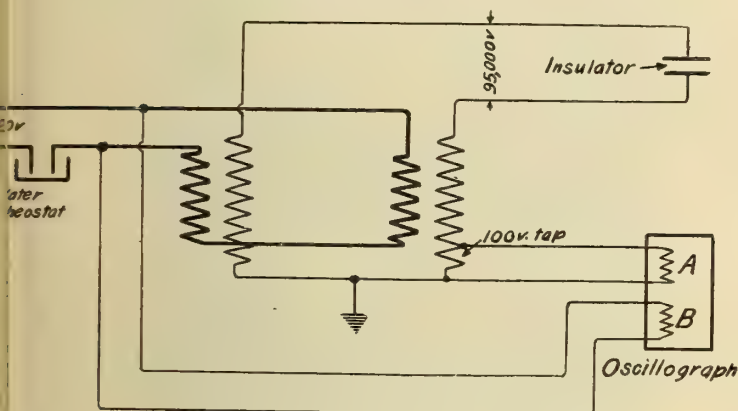


on porcelain unless one can be absolutely sure that the porcelain is non-puncturable. It is safer to have a design having the cable supported away from any point of possible puncture.

Aside from the serious trouble just mentioned, the puncturing of an insulator will tend to cause long interruptions unless replaced, since the puncture hole will form a short air path between live wire and ground that it may break down at normal operating voltage.

#### Routine Test Guaranteeing Porcelain of Even Electro-Static Quality

It has been previously mentioned that in order to obtain a non-puncturable insulator the puncture voltage must be considerably higher than the flash-over voltage of the insulator. The flash-over distance may be considered as a sort of safety valve for the porcelain—the lower it is set the bet-



DIAGRAM, SHOWING CONNECTIONS OF OSCILLOGRAPH TO TESTING TRANSFORMER

Fig. 2.

ter the porcelain will withstand any strain it is subjected to, since, it will bring relief before the breakdown voltage of the porcelain is reached. How high this ratio of puncture to flash-over should be, not to overstress the porcelain for the steepest wave front or the most severe high frequency, is not definitely known, but experience shows that it should be at least 1.5:1 and preferably 2:1.

In the search for a commercially possible routine test which would assure an even product, a ratio of puncture to flash-over of at least 1.5:1, it was determined that a flash-over test of a sharp pronounced high frequency nature was considerably more severe on insulators, even if only on for a few seconds, than a test of any duration near but below flash-over point. Further, it was noticed that the longer a continuous sparking-over continued the more discs were punctured. These observations led to the suggestion that a certain relation existed between the duration of application of the high frequency spark-over and the ratio of puncture to flash-over. A comparative test was made on a large number of discs, subjecting the discs first to a two minute flash-over of absolute continuity and thereafter determining the puncture value of the discs which withstood the test by puncturing them under oil. The result was that all discs which withstood successfully the two minute flash-over test, had a puncture value which was 40 per cent higher than the flash-over voltage. This relation between time of application and minimum necessary ratio of puncture to flash-over may be different on different test-sets, depending upon the characteristics of the whole test arrangement. In a general way, however, it may be said that the ratio will be increased as the short circuit current on the test transformer is choked down. This will be more clearly understood by studying the oscillogram of such spark-over. Fig. 1 shows the oscillogram of the high and low tension voltage of the testing transformer during discharge over an insulator. Fig.

2 gives the diagrammatic connections of the oscillograph to the test circuit. This oscillogram indicates clearly that the flash-over test is more severe than an ordinary test below flash-over, since in case of the flash-over test severe high frequency oscillations are obtained. An explanation of the oscillogram may be given as follows:—The high tension winding of the transformer has a certain electrostatic capacity: If now the momentary voltage impressed upon the insulator, gradually rising from zero, is reaching the flash-over point of the insulator, a short circuit will flow over the insulator. The current will be composed of two super-imposed currents, one being the low frequency current of the energizing power system, the other the transient discharge current of the short circuited electrostatic capacity of the transformer. The transient capacity current will rapidly diminish to zero in the form of a damped oscillation, and will, therefore, not be able to maintain the arc over the insulator when reaching zero point. The low frequency power current, however, would ordinarily be heavy enough to maintain the air broken down, although the voltage may have dropped to zero. Therefore, if the arc is to be extinguished after the transient discharge has occurred, it is essential that the power current be choked down to a very low value. This has been the case in the test shown on oscillogram of Fig. 1. The result was that after the first transient discharge of the capacity was completed, the arc was completely extinguished and allowed the potential to build up again and charge the whole electrostatic capacity of the transformer winding and the insulator. The instant the flash-over voltage was reached again the insulator arced over again and repeated the oscillatory condenser discharge, this phenomena being repeated on each half cycle until a point was reached on the fundamental half wave which was not high enough to flash-over the insulator and starting again when the flash-over voltage is reached on the next half wave.

The number of discharges per half cycle are governed largely by the test arrangement, but can be forced by keeping up the voltage on the low tension side. This oscillogram and the mentioned test results indicate clearly the way to a routine test which should guarantee an electrostatically even, sound porcelain. This can be assured by specifying a flash-over test of absolute continuity of several minutes' duration

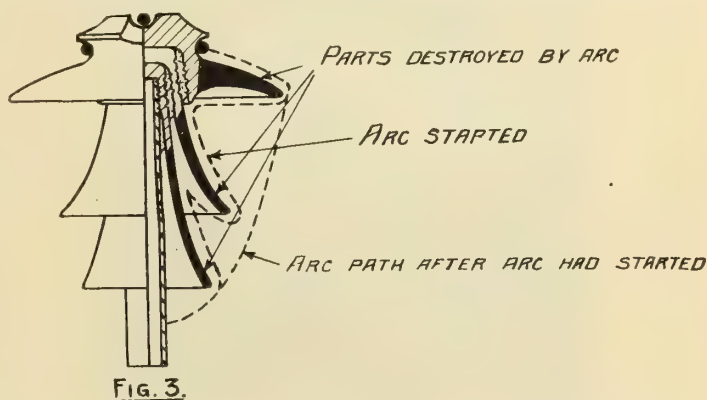


FIG. 3.

with a test arrangement having the power choked down. This is normally indicated by a clean pronounced, sharp crackling high frequency discharge.

#### Weakening of Porcelain While in Operation on Line

One problem, however, remains to be solved even after the means are available for procuring an insulator withstanding puncture when first put up on the line. It has been the experience of most power companies that a slow weakening of the insulators occurs after having been in service for some years, and that insulators which may have stood any kind of flash-over may, after some time, puncture even at normal voltage. No definite answer has been given as yet to this observed weakening and no absolute remedy deter-



nished. However, we can hope that this matter may be cleared up in the near future, since it has been receiving the attention of both manufacturers and power companies.

#### Destruction of Insulators From Power Arc

With the insulators made non-puncturable, a lightning discharge will flash-over the insulator and cause an excessive

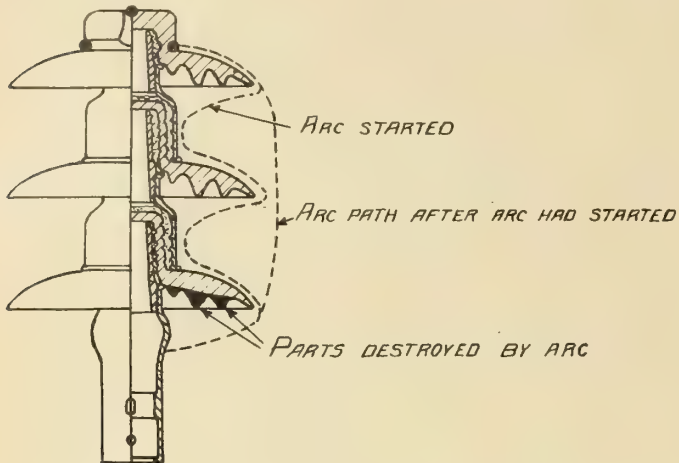


Fig. 4.

dynamic current to follow, developing a so-called power arc with its attendant heat, endangering the porcelain.

The effect of such a flash-over may, under certain conditions, be as destructive as a breakdown due to puncture. There are, however, more possibilities for safeguarding against this action.

Some investigations made by the writer may give a clearer understanding of the points which must be taken into



Fig. 5—Insulator destroyed by 500 amperes power-arc of five seconds' duration.

consideration in determining a means for preventing power arc destruction.

To determine the resistance of certain insulators against heat destruction from power arcs, some tests were made on two types of insulators as shown in Figs. 3 and 4, both being in use on a 60,000 volt line. A 10,000 kw. generator was used to provide a discharge over the insulator at a current rate of 300 to 500 amperes. The arc was started by means of a very thin fuse.

Figs. 5 and 6 show the destruction obtained in various

tests. The pictures are self-explanatory, readily showing the destructive effects of a power arc of several thousand amperes on the line even though the arc be interrupted by instantaneous relays. Comparing the results with the two different types of insulators, a conclusion may be drawn in regard to the general principles which have to be considered in the design of insulators to better resist destruction from power arc.

Fig. 3 is one of the old type insulators with very long petticoats of thin wall-thickness. The hot vapours of the arc are caught in the deep pockets, resulting in the breaking up of the petticoats; the small wall-thickness reduces the resistance to heat destruction.

Fig. 4 represents a new type of insulator built according to the general principle of the suspension insulator. In regard to resistance against power arc destruction, it has the advantageous features, however, of having heavier discs and a shape allowing the vapours greater opportunity to escape. The effect of these features can be noticed by the small destruction indicated in Fig. 4 and Fig. 6, where the

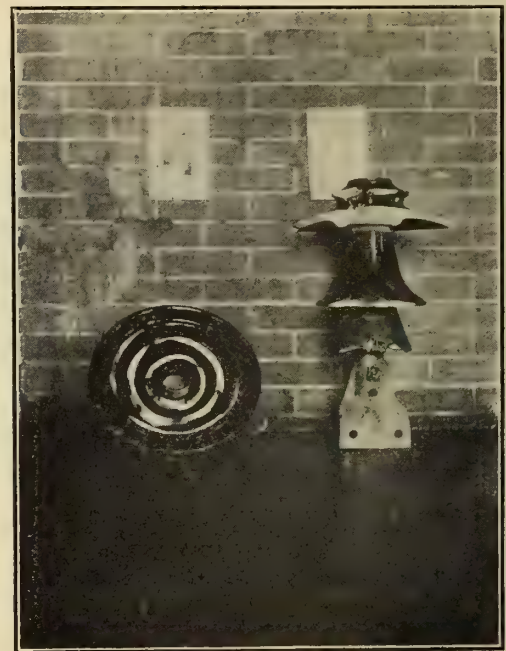


Fig. 6—Insulator destroyed by 400 amperes power arc of five seconds' duration.

1—Three-petticoat insulator.  
4—Bottom disc of disc type insulator. See Fig. 4.

corrugation of the bottom disc only broke off without affecting the insulating quality of the whole insulator.

Recognizing the impossibility of preventing flashing-over over the insulator from lightning surges, and on the other hand recognizing the destructive action of the power arc, a device was considered which would deflect the arc away from the insulator before harm could be done to same. Several such devices are known and some have been in use for several years. However, most of them are so designed that the arc will generally stay at one point on the cable or tie-wire and thus fuse them off. The horn as shown in Fig. 7, therefore, was designed with the object of producing a natural tendency for the arc to follow the line wire and not to rest at any point. The result was very effective, as is indicated in Fig. 8. Arcs were started by a thin fuse on different sides of the insulator and with wind action from different directions. About a dozen discharges were made in still air as well as in wind, and all that could be noticed on the line cable or tie wire were very light surface spots, the arc being carried with great speed along the line cable. It was particularly interesting to note the easy movement of the power arc and its great sensitiveness to the slightest air current. This horn was never tried out in practice, not be-



cause its practicability was questioned, but because another apparatus was then decided on which made any need of an insulator arc protector unnecessary. Some mention may be made of this latter development.

All the features thus far mentioned have tended to improve and protect the insulator in order to prevent serious long interruptions to transmission systems; however, none of

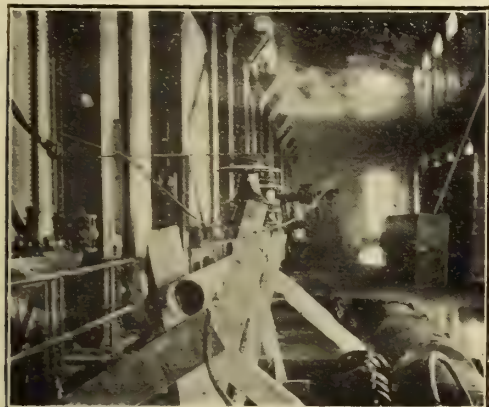


Fig. 7—Horn arrangement used as power-arc deflector.

them will prevent momentary interruptions. Nicholson's arc extinguisher goes one step further and attempts to avoid even the interruption. It is based on the following principle: The instant an arc-over and the resulting short circuit occurs at any point on the line an overload relay located at the generating station will close an artificial short circuit through high tension fuses; this metallic fuse circuit will draw all the current away from the insulator, thus allowing the air around the insulator to establish new insulation. Meanwhile the fuse will blow and rupture the artificial short circuit. This whole process completes its cycle within a fraction of a second, and the result is that the voltage of the system will merely be disturbed for a short time and in a man-

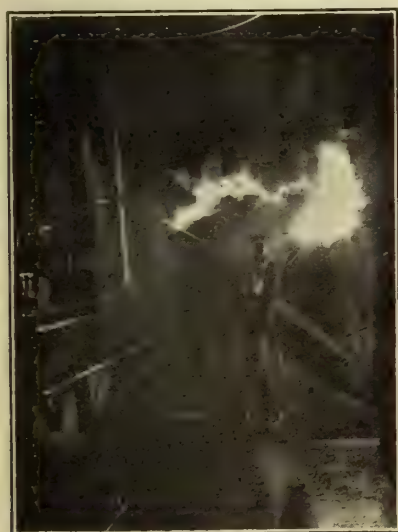


Fig. 8—Power-arc started over insulator and deflected by horn.

ner similar to a short circuit separating itself selectively from the main system.

Synchronous machines may drop out of step if of low synchronizing power; however, lighting and induction motor power will observe a momentary flicker only. The device is decidedly a lightning protection, while for wires swinging together, or for shorts due to outside interference, it will probably not be effective, since the fuse will blow too quickly and allow the arc at the point of trouble to re-establish again;

however, since lightning troubles are by far the most numerous ones, we can be assured that this new method of keeping uninterrupted service over a long distance transmission line has considerable value. The first requirement for its success, however, is the absolute non-puncturability of the insulator.

In the foregoing mention is made of the characteristics of an insulator to reduce line interruption to the shortest possible time, and a device has been described which will prevent interruptions in case of insulator flash-over if the insulator has the proper characteristics of non-puncturability and non-ageing.

From the list of interruptions it can be noticed that with such improvements hope can be entertained of safeguarding against 80 to 90 per cent of our line interruptions.

### Selective Relay Protection

Interruptions from sleet and wind, outside interferences, or short circuits in the distributing system are of such a nature that their prevention must be obtained by a proper selective relay protection, cutting out the faulty part only, without interrupting the main system.

The relay problem is very complex and can only be worked out with full knowledge of a system. Its importance has been recognized only within the last few years and it is only lately that a marked forward step has been made. The design of a relay layout is so largely depending upon the nature of each system that it is difficult to draw up any general rules, and for this reason only a few essentials are discussed.

### Selective Straight Overload Protection

Fig. 9 represents the single wire diagram of a simple transmission system. The purpose of selective straight overload protection is to safeguard against total interruptions due to local troubles in the distributing system.

Assume, for instance, that a short circuit in one of the local distributing feeders could be cut off the main system by its own feeder switch without interrupting the whole sub-

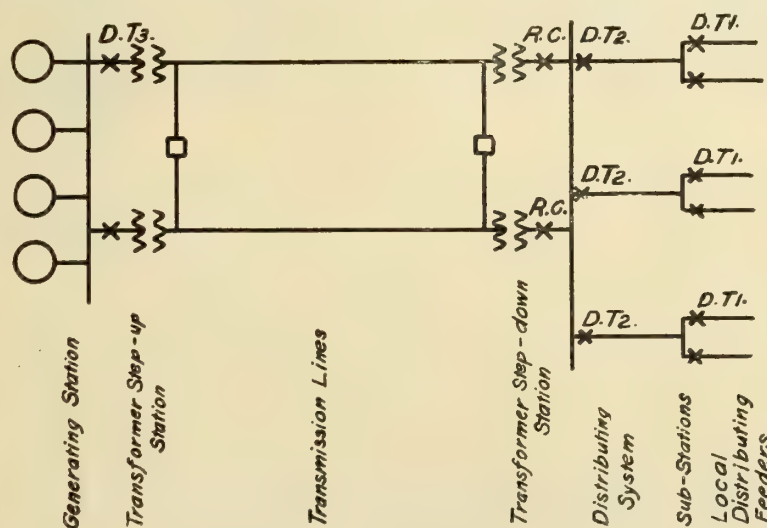


Fig. 9. - SINGLE WIRE DIAGRAM OF SIMPLE TRANSMISSION SYSTEM

station, or, again, that a trouble in one of the sub-stations might clear itself from the main system without interrupting the main system.

This protection requires such characteristics of the relays that they will open the switch nearest to the short circuit before any switch nearer the generating station can open.

Until a few years ago this selective action was attempted generally by inverse time overload relays; devices were



set to trip at a certain overload current within a certain number of seconds; the characteristic of those relays was that the greater the short circuit current the shorter the time element became. The decrease in the time element, however, was so rapid that at a current flow of about two times the current setting—that is, the current at which the relay started to actuate—the action of the relay became practically instantaneous. The result was that not infrequently, due to a heavy short in one of the distributing feeders, where the excess current in the main system reached abnormal value, not only the respective feeder switch tripped, but also all of the switches back to the generating station, thus causing a total interruption. It was attempted to obtain selective action by setting the local distributing feeders for three seconds, the sub-station feeders for six seconds and possibly the lines at the generating station end for nine seconds, but with a heavy short circuit passing through all three settings were practically instantaneous and accordingly all switches tripped simultaneously. From this it will be understood that the first requirement to obtain a selective overload protection is a definite time characteristic for the relay on heavy short circuits—that is, it will require a certain definite time to trip the switch, no matter how heavy the short circuit current may be. With such a relay characteristic the local distributing feeders may be set with a certain time element D.T. 1, the sub-station feeders with D.T. 2, and the generating station switches with D.T. 3, (1) indicating the shortest time element, (3) the longest one, and having such intervals between the three switches that for the heaviest short circuits the switch nearest the short circuit has time to cut the short off before the next switch is actuated. In addition to this first necessary characteristic of the selective overload relay, two other vital characteristics are accuracy and reliability, otherwise the wrong switches may act and may thus impair the selectiveness. The higher the accuracy and reliability the closer successive switches can be set.

So-called definite time relays have been on the market for a number of years, but it is only recently that relays have been devised which combine all three necessary characteristics mentioned above, and it is for these reasons that it is only lately that successful selective, straight overload protection has been obtained.

#### Selective Opening of a Faulty Main Line

This problem is extremely difficult and has thus far not been solved satisfactorily. Present practice is to provide reverse energy relays at the distributing ends of the lines which are supposed to trip the instant the energy flow into the line reverses. Such reversal of energy always occurs on a faulty line on the far end, since current will feed through the good line and the sub-station at the far end back into the faulty line. These reverse energy relays are invariably built on a principle of such interaction between a potential and a current coil that with energy flow in the normal direction the relay contacts are kept open, while upon reversal of energy flow the relay contacts will close. These relays will usually be very accurate on normal voltage. However, on very low voltages some of them will not act at all, like a wattmeter with the potential coil disconnected, or others will act on straight overload. Since, in the case of a short circuit on a line the potential may drop almost to zero, it will readily be understood that relays of such characteristics will lose their selective reverse current feature, and it is quite common experience that their selective action is so unreliable that they cause total interruptions. This is particularly the case where the reverse current protection is put on lines which are tied together on the high tension side, since the short circuit current will then pass from one line to the other through the high tension bus, so that the low tension voltage from which source of relay is invariably energized will drop to zero.

The selective action of the reserve energy relay can be

improved where the conditions permit operation of the two lines with the high tension side sectionalized, thus forcing a short circuit from one line into the other through the transformers and the low tension bus. This will have a tendency to keep some voltage on the low tension bus. However, even with these operating conditions, selective action of reverse energy relays can only be obtained when a relay will trip on very low voltage and power factor; and further, the impedance of the step-down transformers must be comparatively large to maintain sufficient voltage for energizing the relays. Unsatisfactory as this reverse energy relay has proven in the past, no better solution has yet been proposed as far as the protection of two parallel lines is concerned.

The Merz-Price system, which is successfully applied for cable and transformer protection and short distance overhead distribution, is on long distance transmission lines meeting with considerable technical difficulties. Further, it would be rather expensive, since pilot wires would have to be strung between the two ends of the line.

Selective protection of three or more parallel lines can be obtained by taking advantage of the fact that, whenever a short occurs in one line, the current balance in the respective phases of all parallel lines becomes disturbed. Schemes along this line may probably find some application in the future. They will be rather complicated in the wiring layout, as they will require interconnections between the current transformers of the parallel lines; but they will undoubtedly prove very effective, since the troublesome potential element is eliminated so that the heavier the short circuit the more positive the action of the relay.

From these notes on relays it will be observed that a large field for improvement is still open and considerable development is necessary before suitable relay protection for troubles on transmission lines by selective action is obtained.

In conclusion, it may be said that successful efforts are being made to improve the reliability of operation of long distance transmission lines and that hope can be entertained that the insulator problem will be solved at least to such a point that the chief causes of present transmission line troubles will be eliminated, and that with some further development in relays such selective action may be obtained that total interruptions will be safeguarded against.

#### Personal

Mr. J. B. Rannie, who has been connected with the B. C. Electric Railway Company in connection with its Vancouver city service for nearly 25 years has severed his connection with the company. Mr. Rannie's career with the company dates from September, 1889. His first work was on the reconstruction of some cars which had been purchased with the idea of the street railway being operated with horses, later plans providing for operation by electric current. He then served as motorman and conductor on the city lines, finally choosing the front platform as his permanent position. In Mr. Rannie's early days with the company, the Vancouver city lines consisted of a main line about two miles in length and a short spur line of half a mile. During his service with the company he has seen the Vancouver city lines gradually extend until now they cover 95.26 miles of single track. After serving as motorman for a number of years Mr. Rannie was in 1900 appointed traffic superintendent of the Vancouver lines. This post he filled until 1911 when he was appointed traffic agent in connection with the Vancouver lines, a position which he occupied up to the date of his resignation. Mr. Rannie will leave the field of electric railway activity, having purchased a small ranch in the vicinity of Chilliwack, B.C., where he will engage in agricultural pursuits.



# Illumination

## Hamilton's Underground Street-Lighting System

An order made in 1912 requiring all wires in the center of the city of Hamilton (except trolley-wires) to be run under ground, made an underground system of street-lighting necessary; and in 1913, the contract for laying conduits under seven miles of streets was awarded to G. M. Gest, of Montreal, Mr. E. I. Sifton being employed as consulting engineer. The actual work was begun early in September, 1913, and progressed rapidly. The various telegraph and electric companies use the same trench but different conduits and manholes, as shown in a descriptive article which appeared in the *Electrical News* of April 15 last.

The primary cable for street-lighting is run through three and one-half inch single clay conduits; two-inch fiber conduit, laid on the top of the main runs, is used for the



Fig. 1—Erecting standards, Hamilton.

secondary cable. The cable is made by the Standard Underground Cable Company, Hamilton. For the primary circuits, paper insulated, lead covered cable is used, while for the secondary circuits it is No. 6 rubber insulated, lead covered.

There are four 2200 volt primary circuits, with a total load of 200 kw. The three outlying circuits are single phase alternating, and the central circuit is three phase. The feeder transformers, in the manholes, which are the subway type, 220-110/220 volt, and from 3 to 10 kw. in size, were supplied by the Canadian General Electric Company. The secondary circuits are 110/220 volt, with grounded neutral. The lead sheath of the cable is used for the neutral and is grounded to the water pipes at each manhole. Between the last two lights in each circuit the cable has only one conductor, while the rest of the cable has two conductors.

Four hundred cast iron standards, fourteen feet high and weighing six hundred pounds each, are placed from 100 to 200 feet apart on both sides of the streets. These standards are made by the Brown, Boggs Company, Limited, of



Fig. 2



Fig. 3

Hamilton; they were carted about two miles and erected at the rate of thirty-five per day by the Department's motor truck, which also erected the seven thousand concrete poles used in the overhead districts. Fig. 1 shows the truck at work, and Fig. 2 the standard and fixture erected. The standards are bolted to a concrete base and are then plumbed and grouted. A door in the base of the standard affords means of access to the fuse, etc.

The fixtures were made by the Tallman Brass and Metal Company, Hamilton. One of the unique features of



Fig. 4



Fig. 5



the fixture is the way in which it opens to clean the glassware or renew the lamps, Fig. 3. The glassware is a Jefferson Moonstone glass. Ventilation is well provided for, the air inlet being between the fixture and standard and the outlet between the canopy and top of the fixture, which are of spun copper. During the ventilation tests, the maximum temperature within the fixture never rose above 260

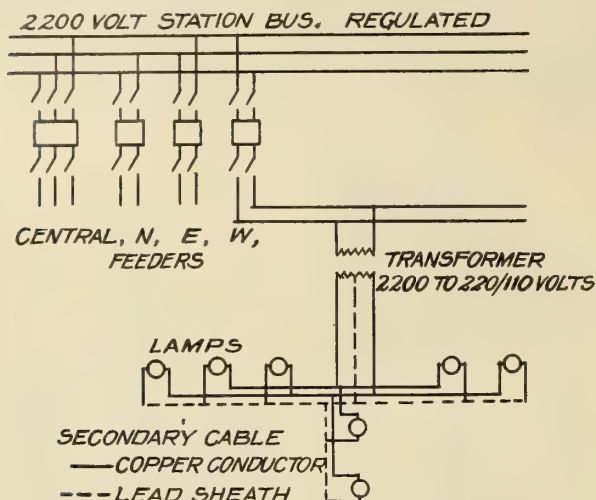


Fig. 6—Hughson Street Sub-station.

deg. F. Figs. 4 and 5 show the fixture assembled and disassembled.

The lamp used throughout the underground district is a nitrogen-filled, 500 watt, 110 volt, Laco-Philips tungsten, connected in multiple. Each lamp is fed by a No. 14 insulated copper wire, connected through a fuse at the base of the standard to the cable and a bare wire directly connected to the lead sheath of the cable.

It was also decided to install thirty-three standards on that part of York Street not included in the underground district, and a different system of construction was adopted. Inch and a quarter galvanized iron pipe is used instead of conduits, and is laid about one foot below the surface of the road, or, where possible, under the strip of grass between the sidewalk and the curb. This pipe was driven under the street-car crossings, and was laid at a much lower cost than that of laying the conduits. The lamps are placed 150 feet apart alternately on each side of the street. The first eight lights are fed from the last underground transformer, while the others are fed from the most convenient overhead lines

station was described in a former issue. The current, after being transformed from 13,200 to 2,200 volts, is passed through C. G. E. induction-type voltage regulators and oil switches. The arrangement of the switches is very simple and is shown in the wiring diagram, Fig. 6.

The photographs of King Street at night, Figs. 7 and 8, show the superiority of the new system over the old. The new system was inaugurated on July 1 last, less than ten months after the beginning of the construction work.

#### Trade Publications

**Direct Current Motors**—Bulletin No. 119, issued by the Robbins & Myers Company, Springfield, illustrating and describing their printing press and linotype d.c. motors.

**Indirect Fixtures**—The National X-Ray Reflector Company have issued a number of data sheets illustrating their indirect fixtures as applicable to the nitrogen lamp.

**Meters**—Bulletin No. 46291 issued by the Canadian General Electric Company describing and illustrating portable test meters, type IB-5 for alternating current circuits.

**Corliss Engines**—Bulletin No. 1529, issued by the Canadian Allis-Chalmers, Limited, illustrating and describing the more important features in their heavy duty Corliss engines.

**Sewing Machine Motors**—Bulletin No. 117 issued by the Robbins & Myers Company, Springfield, illustrating and describing the type F direct current factory sewing machine motors.

**Ventilation of Engine Room**—Pamphlet issued by the Canadian General Electric Company on the subject of "Ventilation of Steam Turbine Engine Rooms," being a reprint from The General Electric Review.

**Linotype Pots**—Publication No. 1531 issued by the Westinghouse Electric & Manufacturing Company, describing and illustrating Westinghouse Wicker type Electric Linotype Pots. The same company have issued descriptive leaflet number 3723 on Baldwin-Westinghouse Electric Industrial Locomotives, and electric leaflet 103, describing a number of catchy window displays which would be valuable to central stations.

**Aluminium Cable**—The British Aluminium Company have issued a very handsome illustrated book entitled "Power, Its Economical Distribution," and descriptive, chiefly, of aluminium insulated cables. The illustrations are unusually good and the information contained covers very thoroughly the characteristics of aluminium cable as well as its manu-

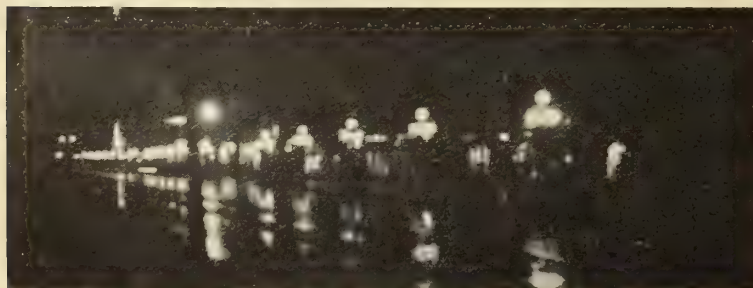


Fig. 7—Tungsten Clusters formerly used.



Fig. 8—New Nitrogen units, Hamilton, Ont.

on the adjoining streets. Tests were made to ascertain the voltage loss due to induction, and it was found that the lead sheath would carry nearly enough return current to neutralize this induction, the voltage drop being reduced to one-half volt per hundred feet. This loss was so slight that it was not deemed worth the expense of an extra conductor in the cable to balance the current and thus to eliminate it entirely.

The transformer equipment at the Hughson Street sub-

factory and installation; in fact, the booklet may be considered a treatise on the subject of aluminium cables.

**Travelling Cranes**—Bulletin B7 issued by the Herbert Morris Crane & Hoist Company, Limited, illustrating and describing their type S2 hand-operated travelling cranes.

**Metal Moulding**—A handbook on "National" metal moulding, issued by the Canadian General Electric Company, illustrating and describing the various "National" mouldings and fittings.



## The Wiring of Large Public Buildings

In accordance with the best practice no wall lights have been installed. These have long proven unsatisfactory both

The Hotel Macdonald is following the most approved practice and installing a centre ceiling outlet in each room with at least three baseboard outlets. This means one base outlet for a writing desk, one for the dresser and one for a reading lamp beside each bed. These baseboard receptacles also facilitate the use of all sorts of modern electrical appliances such as curling tongs, electric irons, small electric heaters, etc., all of which add to the comfort and convenience of the guests. Further, each room is equipped with two





circuits so that in case of trouble on one circuit the guest is not placed at the inconvenience of being without illumination. Each bedroom floor is supplied from three panel boards which lead direct from the main switchboard thereby insuring a portion of the general illumination in each floor under any emergency except an entire break-down of the generating plant in the basement and at the same time of the local municipal lighting system.

The laundry and culinary department are equipped with the latest modern electrically operated apparatus. Electric elevators are installed and a complete electrically-driven ventilating system. The laundry machinery is, of course, of the most recent design and the units are driven, wherever possible, by individual motors.

The lighting is supplied from a 110/220 volt, three-wire, direct-current system. Power is supplied at 250 volts direct-current.

The hotel is supplied with its own generating plant consisting of Goldie & McCulloch engines and Triumph Electric Company (Cincinnati) generators. In addition to the private plant the lines of the Edmonton municipal plant have been extended into the hotel as insurance against break-down in the private plant.

The wiring is in conduit throughout, the material being supplied by the Conduits Company, Limited.

In addition to the features already mentioned a number of floor outlets have been installed; also a time clock system, a telephone system, a fire alarm system, and a vacuum cleaning system. We reproduce herewith a portion of a typical floor plan. The portion reproduced represents perhaps one-quarter of one of the five floors.

#### New Type Radiator

The Canadian General Electric Company are offering a new type radiator, as illustrated herewith, Type A-26, single heat and Type A-51, three heat, have capacities ranging from 1,200 watts to 2,400 watts. Type A-47, similar in appearance but somewhat larger, has capacities ranging from 3 to 5 kw. These heaters consist of a rectangular iron frame, having porcelain coil supports at the top and bottom. Over these supports is strung the heating element, which consists of  $\frac{3}{8}$ -in. diameter coils of resistance wire. Castings are made of



Wellsville blue steel. The cast iron top and base of the types A-26 and A-51 have full nickel finish, while the top and base of the A-47 have black Japan finish.

A Waverley electric 1,000-lb. delivery wagon recently made a trip from Buffalo to Lockport and back, 52 miles in all, bring a 900-lb. load on the return trip in a total running time of three hours and a half. The current used on the round trip was 105 ampere hours, which, at regular rates in Buffalo, amounted to less than 10 cts. On another occasion the same car made the same round trip and about 18 miles

of additional travel, or 70 miles in all, on 130 ampere hours, all at highest speed, the battery having a capacity of 150 ampere hours.

#### Adjustable Panel Boards

The Trumbull Electric Manufacturing Company have issued a folder drawing attention to the adjustable features of their panel boards, boxes, and cabinets. The box is first installed then corner irons as shown in Fig. 1 are securely

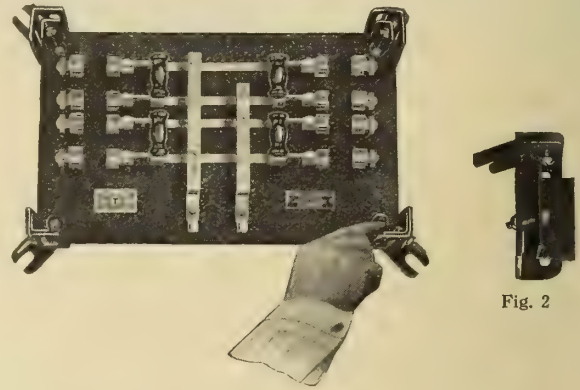


Fig. 1.

Fig. 2

fastened to the base of the panel. Fig. 2 shows an enlarged view of the corner iron from which it will be seen that an air space is provided between the panel and the box. The third operation is to secure the panel in the box and connect up the mains and circuit wires, after which the slate frames are slipped in place as shown in Fig. 3. The practical elec-

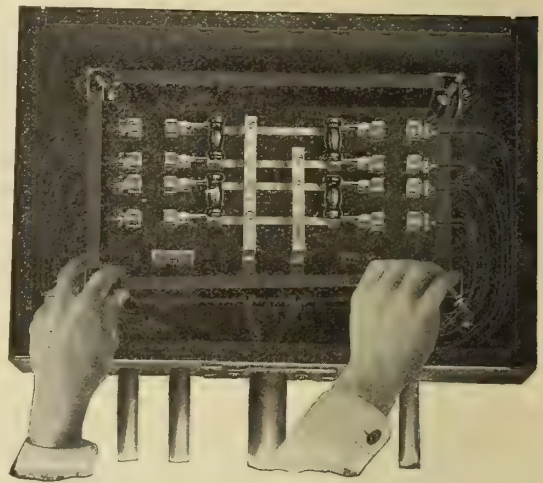


Fig. 3.

trician will appreciate the advantage of being able to make his wiring connections before putting in these walls. This is accomplished by slotting the bottom of the slate frames instead of boring holes for the wires to pass through as is ordinarily done. Aside from the convenience a great deal of time is saved. It is also claimed that with the corner irons as shown the panel is adjustable in any position practically independent of the position of the box. Another feature is the patented hole closer which can be so adjusted that you can get a conduit hole  $\frac{3}{4}$ -in.,  $\frac{7}{8}$ -in., 1-in.,  $1\frac{1}{4}$ -in.,  $1\frac{1}{2}$ -in., or you can close the hole entirely by placing blank ends together.

#### Obituary

After an illness of several months, Mr. James D. Wood, assistant tariff chief of the G. N. W. Telegraph Company, died in Montreal on July 4.



### General Devices and Fittings Company

A new company was recently incorporated under the name of the General Devices & Fittings Company for the manufacture of high grade and original power, light and railway plant appliances and for sub-station and transmission service. These fittings and devices will consist of high tension and low tension appliances such as out-door high tension disconnection switches for high tension devices with a voltage range from 600 to 200,000 volts. This includes bus-bar apparatus of any capacity and any voltage required.

The company will also manufacture bus-tie, bus-sectionalizing, transformer, feeder and generation disconnecting switches of all capacities and for all types of mounting. Indeed, the manufactured products will include large plant equipments complete with the exception of moving apparatus, transformers, instruments and oil switches.

The head office and factory of the company will be located in Chicago though the personnel is well known to the Canadian electrical trade. Mr. E. O. Sessions, president, was formerly with the Thompson-Houston Electric Company and later with the Stanley-G. I. Electric & Manufacturing Company and the General Electric Company and more recently formed a partnership to carry on consulting engineering work. He is a Fellow of the American Institute of Electrical Engineers, a Member of the American Society of

they render the boxes dust proof and for most uses practically water proof. The doors and trims can be finished to match any shade of woodwork though the standard finish is baked black Japan. The absence of wood fronts on distributing cabinets is an excellent idea as it insures a fire-proof installation in every particular.

The Canadian Steel Products Company will also manufacture time switches, sheet steel shop equipment, steel shelving and lockers, portable garages and other sheet steel and electrical specialties.

### A New Flush Receptacle

The Hart & Hegeman Company, of Hartford, Conn., have recently placed on the market a new flush receptacle which is finding favor with the trade. This receptacle is unusually easy to wire up as it takes no time at all to hook up the plug. The base is very compact in size, being only  $1\frac{1}{4}$  inches deep and  $1\frac{1}{4}$  inches wide. The contact sleeves engage the plug fingers over a large conducting area, and while they hold them snugly a slight pull will release the plug. The contacts are sunken and separated by a wall of porcelain, and accessible only through the narrow porcelain tubes; so dust cannot be swept into them, and it would be very hard for a child to short-circuit the device. Because the contacts



Edson O. Sessions.



A. D. Fonger.



J. M. Van Splunter.



New flush type receptacle.

Mechanical Engineers, an Associate of the American Society of Civil Engineers and a Member of the Illuminating Engineering Society. Mr. A. V. Fonger, treasurer, was formerly with the General Electric Company and later with the Electrical Engineers Equipment Company. He is an Associate of the Association of Iron & Steel Electrical Engineers. Mr. J. M. Van Splunter, secretary, was formerly associated with the engineering department of Sargent & Lundy, consulting engineers, and later as construction engineer for the Stanley-G. I. Electric & Manufacturing Company. More recently he was connected with the sales organization of the General Electric Company. The General Devices & Fittings Company will be represented in Western Canada by the Benjamin Richardson Company of Winnipeg.

### Canadian Steel Products Company, Limited

The Canadian Steel Products Company, 227-229 Wellington Street, Montreal, announce that they have completed the equipping of their factory for the manufacture of sheet steel, flush and service cabinets for switches, cut-outs and panel boards. The factory will be under the general management of Mr. S. A. Ungerleider, who has had extensive experience in the United States. The machinery and tools are all of the most modern and improved type.

The boxes are made in one piece of sheet steel, formed and bent in large presses, and the covers are so fitted that

are separated by this wall of porcelain the current cannot jump across, and the narrow porcelain tubes through which the plug fingers are withdrawn have a choking effect upon the arc. Moreover, these porcelain tubes, or sleeves, protrude up into the countersunk holes of the plate, so that it is impossible to draw the arc up to the surface of the plate, and then to have a short-circuit through the plate. This new receptacle is being handled by the Canadian General Electric Company.

### Nitrogen Lamps in the West

The City of Kelowna, B.C., has ordered a complete equipment of Nitrogen Filled Tungsten Lamps varying from eighty to three hundred and fifty candle-power and will light the streets with fixtures spaced one hundred feet apart except in the extreme outlying districts where a spacing of two hundred feet has been adopted. The present arc system is being installed in the business district and the amount of illumination entirely superseded. The larger candle-power units will be in use for some time. The amount of illumination will decrease gradually to the outskirts. Claude R. Yuill, successor to Mather, Yuill & Company, Limited, is consulting engineer for the city.

The 1914 Convention of the American Electric Railway Association will be held at Atlantic City on October 12-16.



# Current News and Notes

## Alberton, N.B.

The town of Alberton, N.B., have just awarded a contract to the Canadian Fairbanks-Morse Company, St. John, N.B., for complete electric light outfit, consisting of dynamo, switchboard and the necessary transmission material for their new town lighting system. The dynamo will be driven by water power.

## Baie d'Urfe, Que.

The council of Baie d'Urfe are installing an arc light system the contract for which has been let to Mr. W. G. H. Cam. This is a continuation of the Beaconsfield system, also installed by Mr. Cam. Energy is supplied from the Beaconsfield sub-station of the Montreal Light, Heat & Power Company. When the Baie d'Urfe installation is finished it will mean the completion of the lake shore lighting system as far as St. Anne de Bellevue where a lighting system is already in operation.

## Bedford, Que.

The different power companies in Montreal are being communicated with having in view the supply of light and power to this village.

## Brantford, Ont.

The sale of the assets of the Grand Valley Railway Company and the Brantford Street Railway Company to the city of Brantford is expected to be completed by August 1.

## Grand Forks, B.C.

The minimum charge for domestic electric light has been reduced to \$1 per month and for power to \$2 per month. It is also announced that when a consumer has paid an amount equal to \$15 for the rental of his meter he shall become exempt from further rentals.

## Halifax, N.S.

Halifax, N.S., and Charlottetown, P.E.I., are now connected by telephone as a result of the laying of a cable across the Strait of Northumberland, by the Dominion Government.

## Hamilton, Ont.

The secretary of the Works Department estimates the maintenance cost of the street lighting system of Hamilton at \$98,000 per annum.

## Hawkesbury, Ont.

The Canadian British Insulated Company have a contract to supply Thomas Ross & Sons, Hawkesbury, Ont., with 4,200 feet No. 0 three conductor submarine cable working at 22,000 volt pressure. The cable will be in two lengths of 2,100 ft. and each reel will weigh 17 English tons.

## Joliette, P.Q.

The council of the Town of Joliette, P.Q., at their meeting of June 24th, awarded to Escher Wyss & Company, of Montreal, the contract for the supply of one 200 h.p. Francis turbine and two belt-driven centrifugal pumps, each of two million gallons capacity. Messrs. Surveyer & Frigon, of Montreal, are the consulting engineers.

## Kelowna, B.C.

Contracts have been awarded for power house equipment as follows:—Engine, condenser and heater, Goldie & McCulloch Company; 200 kw. generator with exciter, Canadian General Electric Company; switchboard panel and equipment, Canadian Westinghouse Company. The consulting engineer for the city of Kelowna is Mr. C. R. Yuill, successor to Mather Yuill & Company, Limited, consulting and contracting engineers, Vancouver, B.C.

## Kincardine, Ont.

The by-law asking money for extension of the city lighting system was defeated.

## London, Ont.

The general manager of the London hydro-electric system reports that there are now 7,400 municipal customers.

## Lucan, Ont.

A by-law was recently passed authorizing the installation of an electric distribution system.

## Medicine Hat, Alta.

Good progress is being made with the automatic telephone system at present being installed in Medicine Hat. Provision is made for 3,000 subscribers.

## Montreal, Que.

The Montreal council have agreed to give the Montreal & Southern Counties Railway facilities for improving their city terminals. The company will be allowed to cross McGill street and establish the terminal on Youville Square, which will give considerably larger space for handling the cars.

After a prolonged hearing, Mr. Justice Archibald, Montreal, has given judgment in the case of Fraser, Brace & Company, against the Canadian Light & Power Company, awarding the former \$65,330. The action was for a balance due on the contract price of constructing the defendants' power plant at St. Timothee, P.Q. The defence was that the work was not completed within the time specified and that the claim was more than met by sums due by plaintiffs to defendants under the head of liquidated damages. His lordship held on this point, that the extra work ordered by the defendants had seriously increased the time necessary for the completion of the contract.

The depression in the Montreal building trade is reflected in the electrical contracting business. New contracts are scarce, and the repair trade is almost negligible. The outlook is by no means rosy, as the indications are that very few large structures will be erected this season.

Operations have been re-commenced on the hydro-electric power project of the Stadacona Power Company, P.Q., additional capital having been secured. The object of the scheme is to develop the Seven Falls on the St. Anne River, 27 miles below Quebec. The power will be distributed to that city and to neighboring places. Mr. A. R. Henry, Montreal, is the engineer, and Mr. E. A. Wallberg, Montreal, the contractor.

For the year ended April 30 the total revenue of the Montreal Tramways Mutual Benefit Association was \$55,904, and the surplus \$19,373. The company made a donation of \$4,000. The total accumulated surplus is now \$136,454.



# TRUMBULL

*"Circle T"*

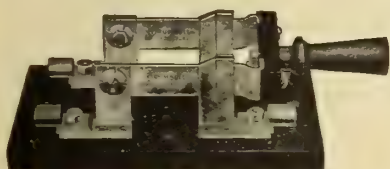


## SWITCHES TYPE "C"



Struck up type. 30-200 Amp.

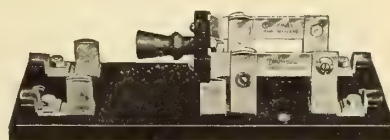
Front Connections plain finish only.



Double Pole No Fuses.



N. E. C. Fusible, High Jaws, Fused Bottom.



N. E. C. Fusible, High Jaws Fused Top.



600 Volts.



500 V. A. C.

Our Type "C" line is the standard for this style of switch.

The best selling punch clip switch on the market.

### A. C. Motor Starting Switches



Type "A" Fusible One End Only.



Type "C" Showing Straps on Back.

See catalogue No. 10 for the most complete line of knife switches on the market.

If you don't know these motor starting switches get acquainted Now.

# The Trumbull Electric Mfg. Co.

PLAINVILLE, CONN.

NEW YORK  
114-118 Liberty St.

CHICAGO  
15 S. Desplaines St.

BOSTON  
76-78 Pearl St.

PHILADELPHIA  
138 N. 10th St.

SAN FRANCISCO  
84-88 Second St.



Statistics of the relief work done during the year show general increases: 1,492 members were treated for sickness or injury, against 1,205 the previous year; \$10,365 was paid out to them, against \$10,065. Unfortunately, the death rate was higher, and \$12,833 was paid for death and burial insurance, against \$7,083. Mr. J. E. Hutcheson presided at the annual meeting of the association, when the following were elected the company's representatives for the year: Messrs. J. E. Hutcheson, E. A. Robert, J. L. Perron, A. Gaboury, D. E. Blair, Patrick Dubee, R. M. Hannaford and A. S. Boyd.

The Montreal Arena Company are about to install an artificial ice making plant, which will be electrically driven. Mr. J. Bennett, of Montreal, is designing the electrical equipment.

The Northern Electric Company have secured the order for 20,000 feet of wire for the Outremont council, the price being \$93.50 per 1,000 feet delivered at the corporation yard.

Mr. Benjamin Smith, A.M.I.E.E., has been appointed electrical engineer of the Canadian Vickers, Limited, Montreal, and has charge of the electrical department of the dry dock and shipbuilding works at Maisonneuve. As we explained in our last issue, practically all the machinery of the plant will be electrically driven. Mr. Smith was formerly with Vickers, Limited, Barrow-in-Furness, England.

#### Port Arthur, Ont.

The city of Port Arthur will experiment on removing their garbage by a special electric railway car, now under construction. The garbage will be collected as at present with teams but will be transferred at two central points in the city. The long team haul to the refuse dump will thus be avoided.

#### Regina, Sask.

A contract has been awarded for a small quantity of single track extension work.

The operation returns of the municipal street railway, Regina, for the week ending June 27th are as follows: Revenue, \$3,702.85; passengers carried, 90,224; passengers carried, including transfers, 102,697.

#### St. Catharines, Ont.

The hydro-electric street lights were officially turned on in St. Catharines on June 27th.

#### Saskatoon, Sask.

The city council at their meeting of June 29th accepted the tender of Messrs. Escher Wyss & Company, of Montreal, for one steam turbine-driven centrifugal boiler feed pump. The same company were also awarded a contract for one four-million gallon motor-driven centrifugal pump to operate against a head of 162 feet and one four million gallon motor-driven centrifugal pump to operate against a head of 40 feet. The motors and switchgear are of the Canadian General Electric Company's manufacture.

The city of Saskatoon have closed contracts for a quantity of power cable and electrical equipment. The order for 18,500 feet of 11,000 volt, 4 conductor, armoured cable has been given to the Canadian British Insulated Company, Montreal, and for 4,000 volt, four conductor cable to the Eugene Phillips Electrical Works, Limited, Montreal. The tender of the Western Electrical Company, Saskatoon, for three 400 kw. transformers, three 25 kw. transformers and switchboard equipment was accepted.

Contracts for electrical extensions, amounting to approximately \$35,000, have just been awarded by the City Commissioners. The contracts include one for the laying of a cable from the local power house to the huge Domin-

ion Interior Elevator on the outskirts of this city. All the successful contractors were local firms.

#### Three Rivers, Que.

The question of the installation of an electric railway in Three Rivers has been again revived. Mr. Jas. Bennett is retained as consultant.

#### Toronto, Ont.

The purchase of the entire plant of the Simcoe Railway & Power Company by the Hydro-electric Power Commission of Ontario is announced. The purchase includes both the plants of the Power company and their transmission system. The Commission also report excellent progress at Eugenia Falls, where both contractors are already hard at work. It will not be long before this section of Ontario is in a position to furnish from twenty to thirty thousand h.p. of hydro-electric energy.

General Superintendent Ross, of the Post Office Department, has forwarded the following interesting announcement to the city council: "A contract has been entered into between the Post Office Department and the Dominion of Canada Postage Stamp Vending Company, Limited, of Toronto, and authority has been given for the erection of mail boxes on the streets. These boxes will require electrical means for illuminating and operating services and I am instructing the city accordingly."

The Ratepayers' Association of Lambton Mills and Scarlett Plains, two suburbs of Toronto, are co-operating to obtain a Sunday car service from the Toronto Suburban Railway Company.

The new Bathurst Street branch of the Bell Telephone Company's system, serving some 5,000 subscribers, was cut into service Saturday, July 4th, with something less than a minute's delay.

#### Winnipeg, Man.

The gross operating revenue of the Winnipeg Municipal Electric System for the year ending April 30th, 1914, as just made public by Mr. J. G. Glassco, general manager of the system, was \$865,805.19. Operating expenses were \$490,582.06. After allowing for interest and depreciation to the extent of \$295,141.45, there is a net revenue remaining of \$81,897.45.

A contract has lately been awarded to the Canadian Westinghouse Company by the city of Winnipeg for the supply and installation of two 6,000 kv.a. synchronous condensers with necessary transformers. These machines are to be installed at the terminal station of the Light and Power Department for the sole purpose of improving the power factor of their system, and it is not the intention to impose on them any mechanical load. It is expected to increase the capacity of the transmission line by 50 per cent. by this means. The switching equipment in this connection will also be supplied by the Canadian Westinghouse Company.

A contract has been awarded by the city of Winnipeg to the Canadian Westinghouse Company for two single phase, 2,200 volt feeder induction regulators of 44 kv.a. capacity each.

The Standard Underground Cable Company have been awarded a contract by the city of Winnipeg for 40,000 pounds of weather-proof wire.

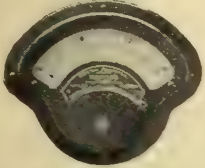
The Canadian General Electric Company have been awarded a contract by the city of Winnipeg for 500 to 1,000 electric irons.

The Canadian British Insulated Company have been awarded a contract by the city of Winnipeg for 5,500 feet of 250,000 c.m., 13,000 volt, 3-conductor cable, the contract to include installation and jointing under a five-year guarantee.





Model 280, Single Range  
Portable Voltmeter.  
(One-quarter size.)



Model 267, Switchboard  
Ammeter.  
(One-quarter size.)

They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity.

They are substantially constructed and may be safely sent long distances through the mails and will withstand an extraordinary amount of vibration without injury.

They have the longest scale ever provided in instruments with equal length of pointer.

Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year.

The portable instruments may be conveniently carried in the coat pocket.

The prices have been established upon so low a scale that any one may possess one or more of these remarkable instruments at moderate cost.

If you cannot obtain the instrument desired from your dealer, write us.

The several models and ranges offer a selection from over 300 different combinations, listed in Bulletin No. 8. Will be mailed upon request.

**WESTON ELECTRICAL INSTRUMENT COMPANY, Main Office and Works, NEWARK, N.J.**

Mr. Stanley Brown, 114 Liberty  
St., New York City.

Badt-Westburg Elec. Co., 832  
Monadnock Block, Chicago, Ill.

Mr. F. E. Gilbert, 303-4 Hale  
Bldg., 1326 Chestnut St., Phila-  
delphia, Pa.

Mr. Geo. H. Moseman, 176 Feder-  
al St., Boston, Mass.

Mr. Milton Mill, 915 Olive St.,  
St. Louis, Mo.

B. K. Sweeney Electrical Co.,  
2910 Huron St., Denver, Colo.

Mr. Frank E. Smith, 682 Mis-  
sion St., San Francisco, Cal.

Mr. S. C. Dinsmore, 1933 Dime  
Bank Bldg., Detroit, Mich.

Walter P. Ambros Company, 1729

East 12th St., Cleveland, Ohio.

A. H. Winter Joyner, Ltd., No.  
76 Bay St., Toronto, Canada.

Weston Instrument Co., Ltd.,  
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lin, Germany.

Mr. D. R. Petest, 415 Fourth  
Natl. Bank Bldg., Atlanta, Ga.

Mr. Edwin Wortham, Suite 28

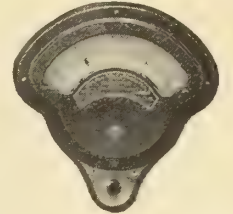
Allison Building, 8th St. and Main  
St., Richmond, Va.

Montreal }  
Winnipeg } *Northern Electric Company*  
Vancouver } (LIMITED)

Calgary }  
Weston Electrical Instrument  
Co., Audrey House, Ely Place,  
Holborn, London, E.C.



Model 280, Triple Range  
Portable Volt-Ammeter.  
(One-quarter size.)



Model 268, Switchboard  
Volt-Ammeter. Reads  
Amperes. Press Button  
for Volts.  
(One-quarter size.)

# WESTON

## Miniature Precision Instruments for Direct Current

A new group of very small Indicating Instruments.  
**COMPACT—ACCURATE—DURABLE—BEAUTIFUL**

### PORTABLE

Voltmeters, Millivoltmeters, Volt-Ammeters, Ammeters, Mil-Ammeters are supplied in single, double and triple ranges.

The Volt-Ammeter comprising six instruments in one.

This group also includes BATTERY TESTERS.

### SWITCHBOARD

Voltmeters Volt-Ammeters Ammeters Mil-Ammeters

This new line of instruments represents the latest development of the pivoted moving coil, permanent magnet type for low ranges.

The refinement of design and mechanical work in them has been carried to a degree which would appear to be almost impossible of accomplishment, if the results were not evident in the instruments themselves.

They embody characteristics which have made the well known Weston

Standards famous throughout the world.

They are accurate, dead beat and extremely sensitive.

They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity.

They are substantially constructed and may be safely sent long distances through the mails and will withstand an extraordinary amount of vibration without injury.

They have the longest scale ever provided in instruments with equal length of pointer.

Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year.

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B. K. Sweeney Electrical Co.,  
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Mr. Frank E. Smith, 682 Mis-  
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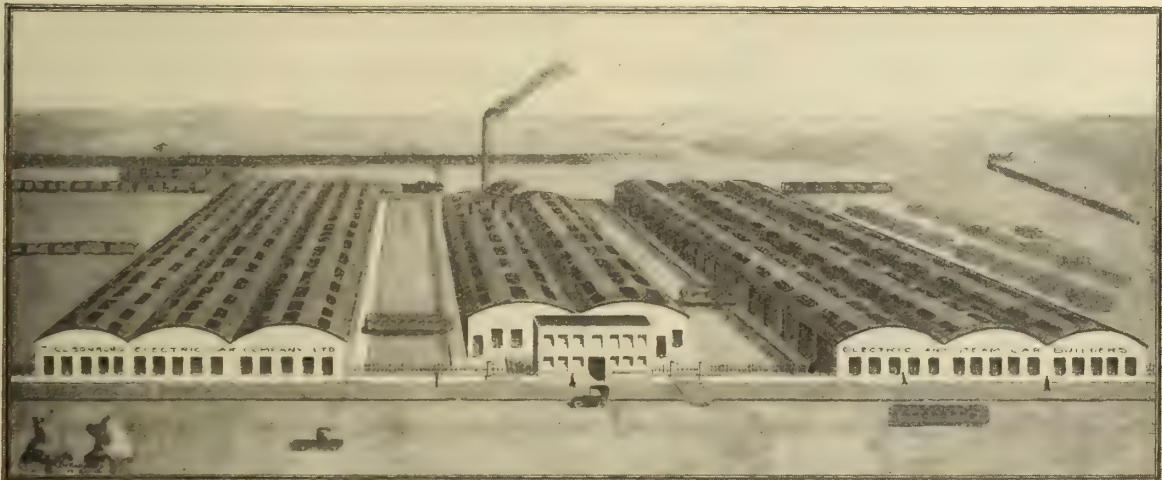
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Allison Building, 8th St. and Main  
St., Richmond, Va.

Montreal }  
Winnipeg } *Northern Electric Company*  
Vancouver } (LIMITED)

Calgary }  
Weston Electrical Instrument  
Co., Audrey House, Ely Place,  
Holborn, London, E.C.



## The Tillsonburg Electric Car Co., Limited

Manufacturers of

## ELECTRIC CARS, SWEEPERS AND SPRINKLERS

Orders for electric cars are now coming in fast and building operations are in full swing.

Will you need new equipment for summer delivery? If so get in touch with us as soon as possible in order that you may rely on getting your cars when needed.

Office and Works,

Tillsonburg, Ontario



# Condensed Department

## Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

## FOR SALE

250 kv. a. Canadian Westinghouse Company generator, A.C., 2200 volts, 60 cycle, three phase, 257 r.p.m.

150 h.p. Gas Engine, speed 275 r.p.m., manufactured by Bruce Macbeth, Cleveland.

Both machines are new, being installed six months ago.

T. B. DUNDAS,  
Wallaceburg, Ont.

14-15

## SITUATION WANTED

Chemist — graduate of Nancy's University, France. Two years laboratory practice. Thorough knowledge of all industrial analysis.

R. RADEFF.

1064 St. Catharine E.,  
Montreal

14-15

## Business Opportunity

Eastern Manufacturers or Supply Houses wishing Manager for Western Branch would do well to apply to undersigned Technical Engineer with ten years' experience in Constructing, Estimating, Selling, and Managing. Engineer, Box 486, Winnipeg. 12-13-14

## SECOND HAND ELECTRICAL MACHINERY

Bought, sold, rented, and exchanged. We have the largest stock in America. Send for our monthly bargain sheet showing complete stock with our prices.

**GREGORY**  
**ELECTRIC CO.**  
CHICAGO, ILLINOIS  
Established 1893

**CANADIAN OFFICE & SCHOOL FURNITURE CO. LIMITED**  
PRESTON ONT.

FINE BANK OFFICE, COURT HOUSE & DRUG STORE FITTINGS

OFFICE, SCHOOL, CHURCH & LODGE FURNITURE

SEND FOR CATALOGUE

J. L. JONES - 1908



**Contracting Engineers**

300 Read Building, MONTREAL

Specialists in underground conduit construction, power plants, transmission lines.

**P** PROCURED IN ALL COUNTRIES  
LONG EXPERIENCE  
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**RIDOUT & MAYBEE**  
59 Yonge Street  
TORONTO, - - - CANADA

## Electrical Machinery

Motors, Dynamos, Generators,  
Electrical Pumps and Supplies.  
Electrical Contractors.  
Motor Repairs.



52 Queen Street - OTTAWA

## Lighting Schedule for August, 1914

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
Aug. 1	11 20	Aug. 2	4 10	4 50
3	0 30	3	4 10	3 40
4	1 30	4	4 20	2 50
5	No Light	5	No Light	
6	No Light	6	No Light	
7	No Light	7	No Light	
8	7 40	8	9 50	2 10
9	7 40	9	10 10	2 30
10	7 30	10	10 30	3 00
11	7 30	11	10 50	3 20
12	7 30	12	11 20	3 50
13	7 30	13	11 50	4 20
14	7 30	15	0 20	4 50
15	7 30	16	1 00	5 30
16	7 30	17	2 00	6 30
17	7 20	18	3 00	7 40
18	7 20	19	4 20	9 00
19	7 20	20	4 30	9 10
20	7 20	21	4 30	9 10
21	7 20	22	4 30	9 10
22	7 20	23	4 30	9 10
23	7 20	24	4 40	9 20
24	7 10	25	4 40	9 30
25	7 10	26	4 40	9 30
26	7 10	27	4 40	9 30
27	7 10	28	4 40	9 30
28	7 10	29	4 40	9 30
29	10 20	30	4 40	6 20
30	11 30	31	4 40	5 10

Total Hours.....169.00



## - M I C A -

We can supply your requirements in

## Canadian Amber Mica

Thumb Trimmed

Cut to Size

With our mines at Rideau Lakes and unexcelled shipping facilities by rail and water, we are in a position to supply your requirements on shortest notice.

The Stoness-Anglin-Gilbert Mica Mining Co., Ltd.

Head Office and Factory  
Kingston Ontario Canada

## Tenders

A few dollars spent in advertising your proposals in

## The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.



# Hold On

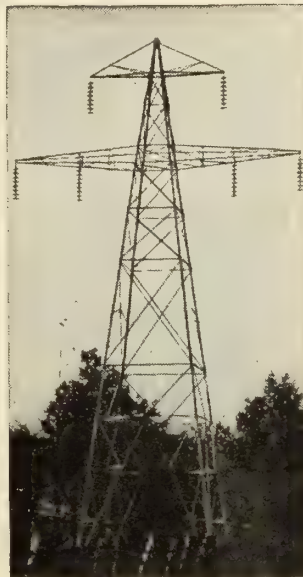
That is what you want your Rail Bonds to do. There are several kinds of bonds that will do it. There is **one** kind that not only will hold on, but absolutely will not corrode at the terminals.

Electric Welded bond terminals are guaranteed.

## The Electric Railway Improvement Co.

Cleveland, Ohio

# TRANSMISSION TOWERS



Hot Galvanized or Painted

Estimates furnished on application

## The Canadian Bridge Co.

Limited

Walkerville, Ontario, Canada

MANUFACTURERS OF

STEEL RAILWAY AND  
HIGHWAY BRIDGES

Structural Steel of all kinds

### DOUBLE CIRCUIT TOWER

One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario. Transmitting a 110,000 volt current from NIAGARA FALLS to the principal cities of ONTARIO. The largest single order of Transmission Towers ever placed.

# "Knight" Fixtures

Prices Right

Finish Guaranteed

Fixture Parts—Chain—Loops—Pans—Castings, etc., carried in stock at all times for immediate shipment.

**We want YOUR next order.**

THIS SEAL ON  
ELECTRIC  
FIXTURES  
STANDS FOR  
QUALITY—  
LOOK FOR IT.



DROP A CARD  
AND OUR  
TRAVELLER  
WILL CALL,  
GLADLY.

**H. W. Knight & Bro.**  
TORONTO 86 Richmond St. E.

# "SHAWMUT" Electrical Material

Enclosed Fuses

Fuse Blocks

Porcelain Cutouts

Fuse Wire and Ribbon

Fuse Links

Ground Connection Clamps

Nipples and Couplings

Stage Pockets and Plugs

Metal Cable Clips, Etc.

Manufactured by

**CHASE-SHAWMUT CO.**  
Newburyport, Massachusetts

**FRANK G. SCOFIELD**

REPRESENTATIVE FOR ONTARIO

702 LUMSDEN BLDG.

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# Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

*Prompt Shipments from Canadian Factory.*

**BOSTON INSULATED WIRE & CABLE COMPANY**

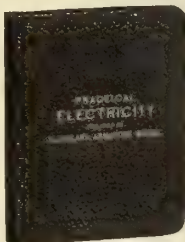
Canadian Office and Factory, HAMILTON, ONT.

## ELECTRICAL MACHINERY

AND REPAIRS

Armatures Complete  
Armatures Rewound  
Armature Coils  
Armature Shafts  
Field Coils

Commutators New,  
Refilled or Assembled



Every electrician  
should have a  
copy of this book.  
Price - \$2.00  
delivered

CLEVELAND ARMATURE WORKS, Cleveland, Ohio

# MICA

## KENT BROTHERS

Kingston, Ont., Canada

Miners, Exporters and Dealers in  
Canadian Amber Mica.

Thumb Trimmed, Cut to Size,  
Splittings, Discs, Washers, Etc.

Write us for prices and let us figure on your  
requirements.



**7 CEDAR POLE YARDS IN B. C.—7**

For prices on B. C. Cedar Poles address

**WESTERN LUMBER & POLE COMPANY**

Main Office - DENVER, COLO.

## ASK US about Efficient

## Lighting

for your streets, factory, warehouse  
or yard

**A. H. WINTER JOYNER, Ltd.**

76 Bay Street, Toronto

"Consult A Specialist"

## G. & McC. Vertical, Forced Lubrication Quick Revolution Steam Engines

In Single Cylinder, Twin, and Two or Three Cylinder Compound Designs,  
specially designed for Direct Connection to Electric Generators.

ASK FOR OUR ILLUSTRATED BULLETIN NUMBER 25

## The Goldie & McCulloch Co., Limited

Head Office and Works: Galt, Ont., Canada

Branch Offices: Toronto, Winnipeg, Montreal and Vancouver



## THE NEW ALKLUM ACCUMULATOR

### Special Advantages:

NO LEAD. NO ACID. NO CELLULOID CASE

#### Strength:

Cannot be hurt with overcharging or running down to Zero.

#### Size:

Smaller than any other Accumulator.

#### Life:

Ten times the life of Lead Accumulators.

#### Reliability:

The Voltage keeps practically the same all the time used.

#### Weight:

The Lightest in the World.

#### Convenience:

Having very wide charging rates.

Far in advance of any other Accumulator for Hand-lamps, because it can be left for any length of time without deteriorating. Absolutely the Best for Miners' Lamps, because it gives off the same amount of current the whole of the time it is in use, maintaining the light evenly throughout the day. Most satisfactory for Electric Self-starters. A great advantage over any other Accumulator for lighting cars.

Fully Descriptive Catalogue sent on application to the Makers

## WORSNOP AND CO., LTD.

LAMP WORKS, HALIFAX, ENGLAND.

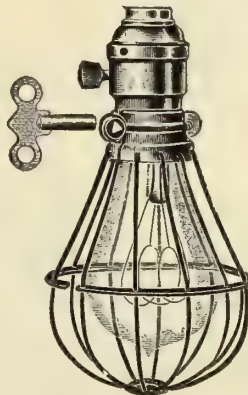
Who are also the largest makers of Electric Motor Lamps in the World.

### GUARANTEED TO BE SUPERIOR TO ANY OTHER ACCUMULATOR IN THE WORLD.

## LOXON LAMP GUARD

THE KEY TO SAFETY

## The Logical Guard To Use and Sell



It should not take much argument to convince any dealer, jobber or central station that Loxon is the satisfactory guard to sell; nor a lamp consumer that it's the best to use.

It's double protective feature Absolute Safety against both Breakage and Theft, give it a selling value you can't get away from. Its reasonable cost to users, a good profit for dealers—make it the right guard to push.

Fall and Winter is the time when Loxons save big money.

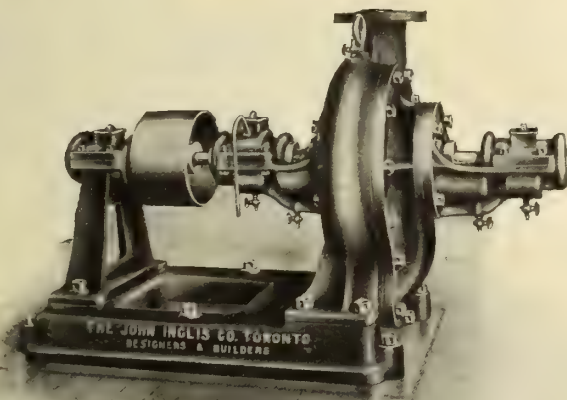
Make no mistake—

Get the genuine Loxon—Made only by

## McGill Mfg. Co.

5 Oak St., Valparaiso, Ind.

## "INGLIS" TURBINE PUMPS



"Inglis" Turbine Pumps are the best by actual test—our pumps are in operation from Coast to Coast and in every case are giving absolute satisfaction.

*Write us for prices*

Horizontal Belt Driven Turbine Pump Supplied  
Toronto University

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Engineers and Boilermakers

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Montreal Office:—Room 509 Canadian Express Building



**ILLUMINATION PROBLEMS**

carefully executed

by

**A LIGHTING SPECIALIST**

See us about House Wiring.

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**Electric Lighting Specialists Co.**

Room 304A Tyrrell Bldg., 95 King St. E., Toronto

J. C. Salvaneschi, Manager.

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Ingot Sheet Wire Rod Tubing

**Northern Aluminum Co.**1305-6 Traders Bank Bldg. Limited  
Toronto, Ont.

TRY ONE OF OUR

**MORRIS  
CHAIN  
BLOCKS**

IT WILL GIVE YOU A LINE ON THEM ALL.

**THE HERBERT MORRIS CRANE  
& HOIST COMPANY, LIMITED,**

EMPRESS WORKS, PETER STREET.

TORONTO.

**M I C A**

Canadian Amber

Indian Ruby

For Every Purpose

Cut or uncut, stamped to pattern. Selected to cut any size or in regular grades. Splittings, Washers, Gramophone Discs. I also carry the largest stock of Stove Mica in Canada.

*Write for prices and samples.***S. O. FILLION**

Miner, Importer and Wholesale Dealer

86-88 Duke St. - OTTAWA, Canada

BRANCHES—34 West 33rd St., New York Kodarma, Bengal, India

**FELTS**

Dust and Oil Rings, Buffers, Lubricating Pads, Wicks for Fan Motors, and felts of every kind for electrical and mechanical uses.

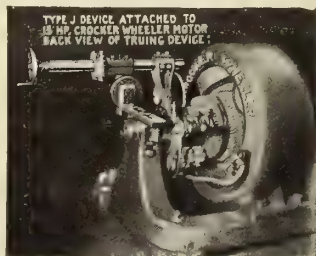
**The Booth Felt Co., Limited**  
GANANOQUE, ONT., CANADA**The Jordan Commutator Truing Device**

Operates without removing armature. No shut down of motor or generator.

No large cuts from commutator and no unnecessary waste of copper.

No dragging of copper causing short circuits.

No portable slide-rest with the danger of the tool digging into the commutator and numerous other chances of damage to the commutator or armature which are all overcome with this machine.

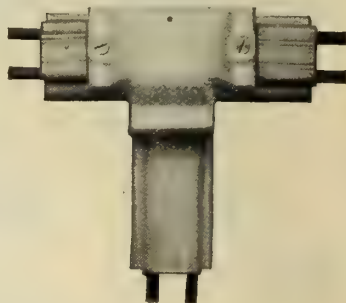
**JORDAN BROS., Inc., 74 Beekman St., New York**

Represented by: Frank E. Filer, Winnipeg, Can.

**The Jordan Tapon for Moulding Work**

A real time saver which means a Money Saver, making the best class of work.

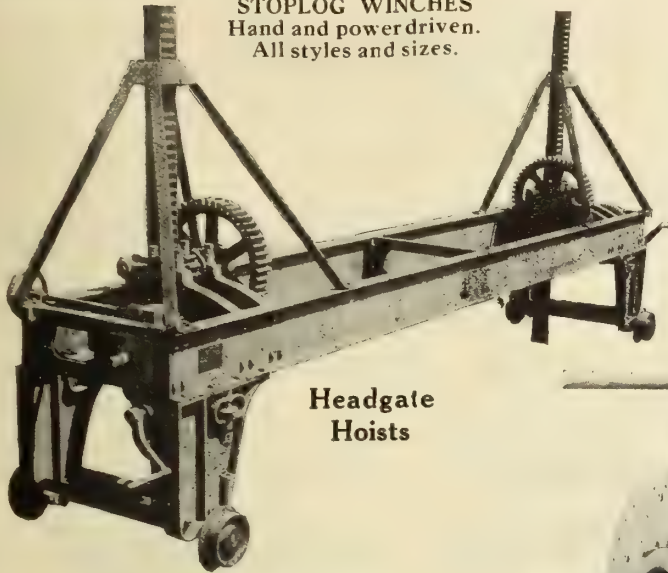
It is not necessary to have the ends of the capping straight as the cover of the Tapon overlaps the capping, thereby covering any bad ends of capping.

**JORDAN BROS., Inc., 74 Beekman St., New York**

A. Hall Berry, General Sales Agent, 97-99-101 Warren St., New York City



**STOPLOG WINCHES**  
Hand and power driven.  
All styles and sizes.

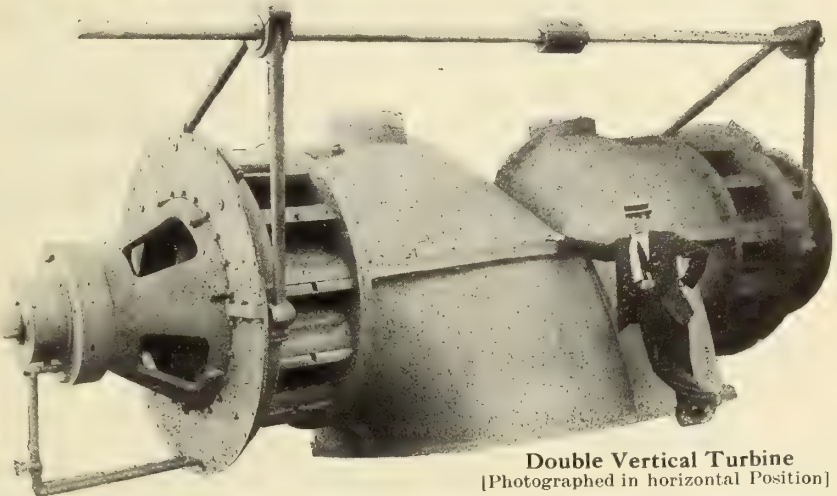


**Headgate  
Hoists**

**Machine Cut Gears**  
Extra large stock patterns for  
**Heavy Bevel Gears**  
having wood and iron teeth.  
**Heavy Pulleys and**  
**Bearings, etc.**

## Water Power Plant Machinery

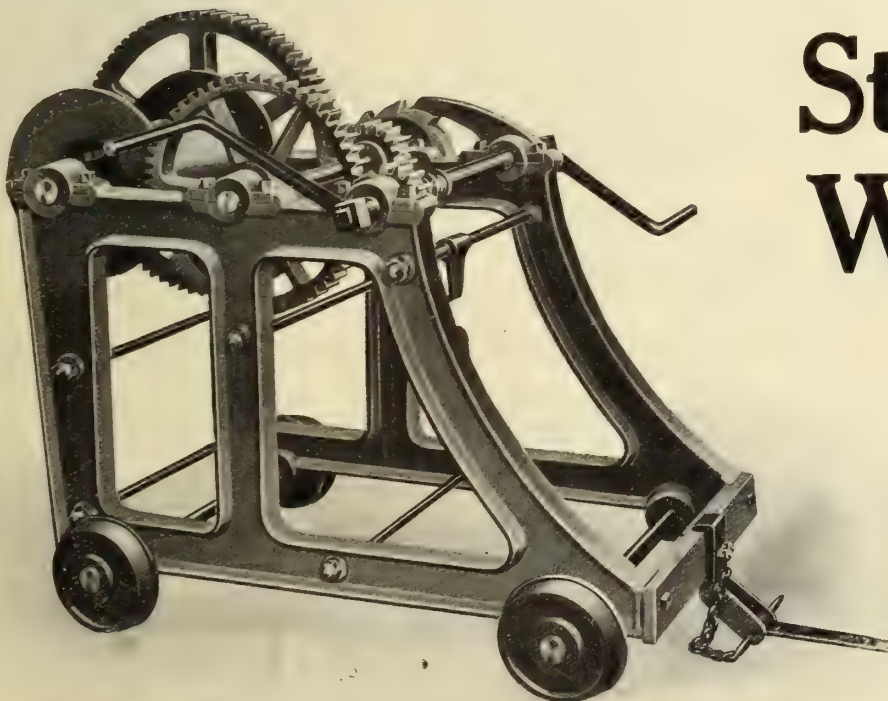
**Steel Castings**  
**Propeller Wheels**



**Double Vertical Turbine**  
[Photographed in horizontal Position]

**THE WM. KENNEDY & SONS, LTD., Owen Sound, Ont.**

## Stop Log Winches



These stop log winches are double geared, have an all iron frame and are strongly built and powerful in operation.

We build a complete line of winches, head gate hoists, sluice gates, etc., suitable for all conditions.

**Catalogues and  
drawings on request.**

**William Hamilton Company, Limited**  
Peterborough, Ontario



Electrical  
Mechanical

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Estimates, Plans and Supervision of Hydraulic  
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"Electrical, Photometrical and Physical  
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MECHANICAL STEAM ELECTRIC  
HYDRAULIC EXAMINATIONS  
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WRITE FOR TERMS. M. 3713.

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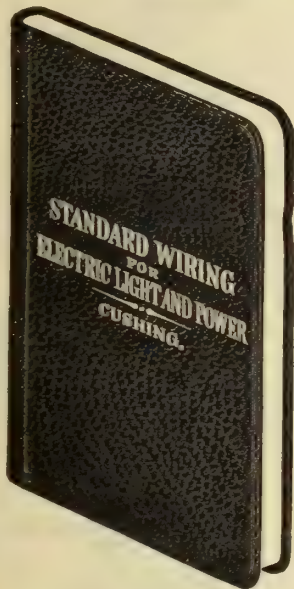
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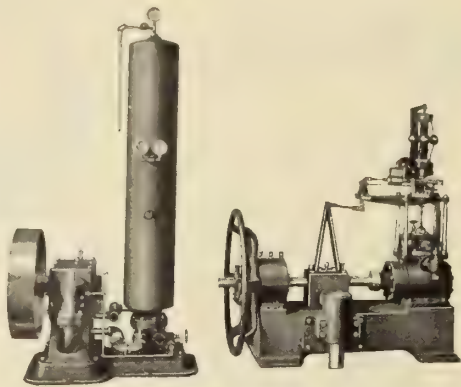
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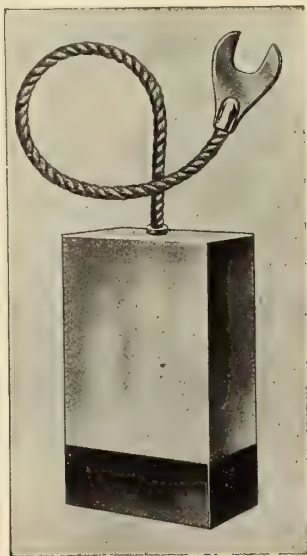
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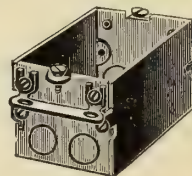
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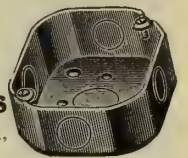
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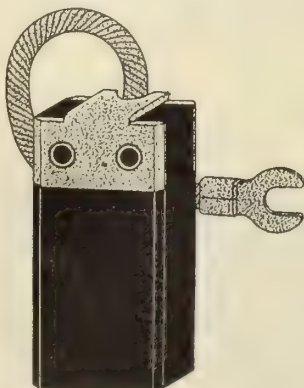
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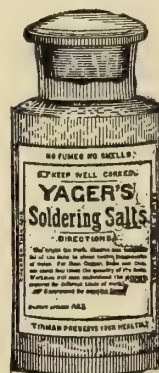
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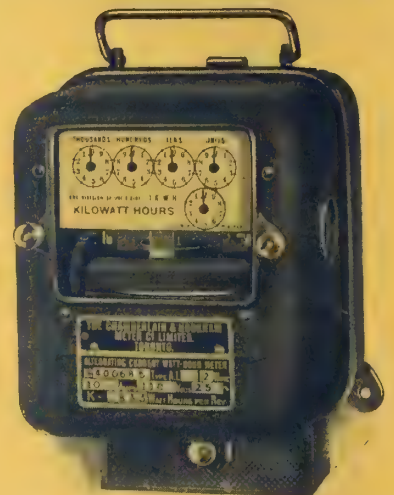
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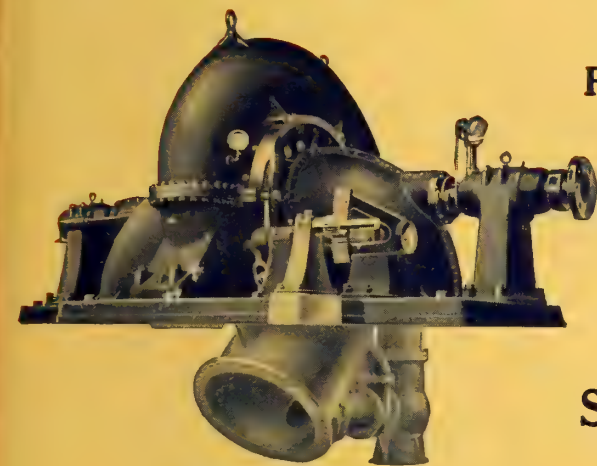
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Generation, Transmission and Application of Electricity



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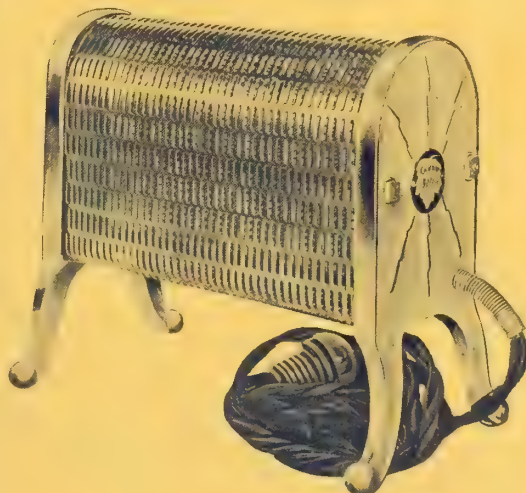
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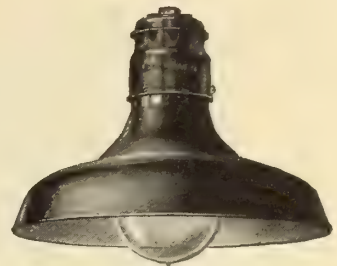




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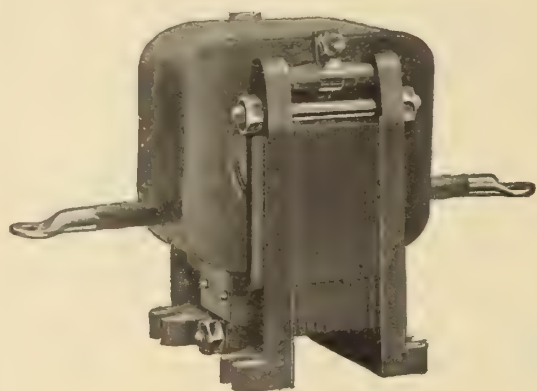


Cat. No. 5549  
Angle Reflector



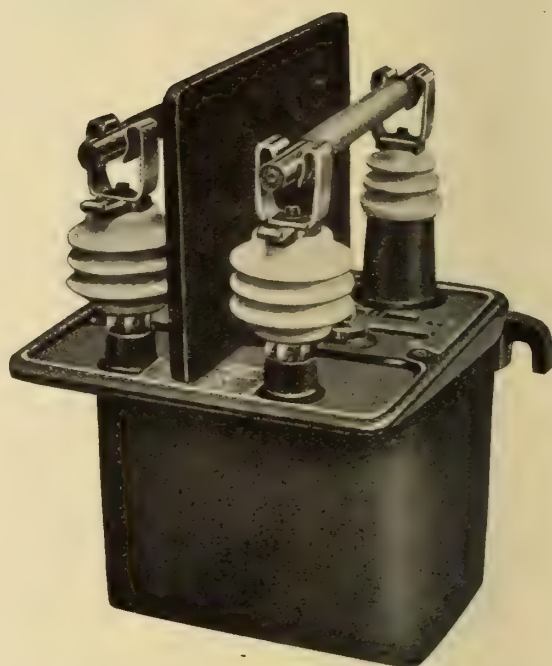
Cat. No. 969  
Indoor or Outdoor Unit





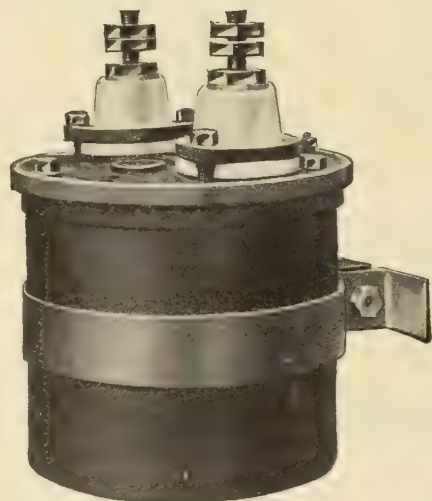
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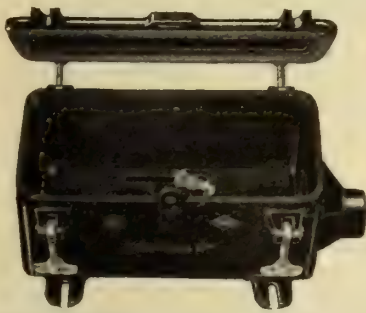
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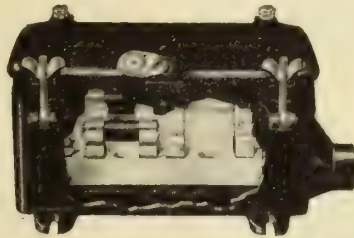
# Water-Tight Housings for Knife Switches with Fuses

## Types YKW and YKWC Condulets

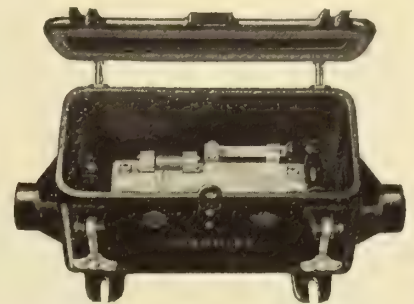
Made in capacity sizes for Two and Three-Pole Switches, 30 Amp. 125 or 250 Volt, to 200 Ampere 250 Volt ; also in Hub Sizes to fit  $\frac{1}{2}$  to 3-inch Conduit. Thirty and Sixty Ampere sizes furnished with Gasket, Universal Fastening Plate, Bolts and Screws. One Hundred and Two Hundred Ampere sizes furnished with Gasket and Fastening Screws.



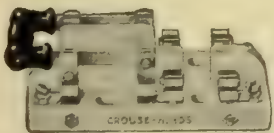
Type YKW Condulet, 30 to 60 Amp. capacity. Door open, showing gasket, fastening plate and bolts.



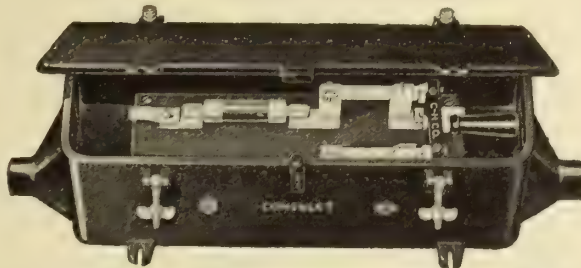
Type YKW Condulet, with door locked. Cut-away view, showing Two-pole Type YKK Switch mounted.



Type YKWC Condulet, 30 to 60 Amp. capacity. Door open, showing Two-pole Type YKK Switch mounted.



Two-pole Type YKK Switch, 30 to 60 Amp., 250 Volt. Arranged for Cartridge Fuses.



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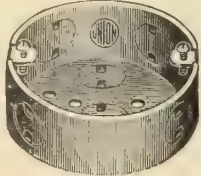
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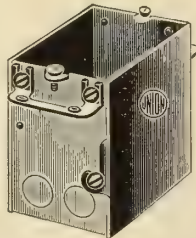


No. 103 Box

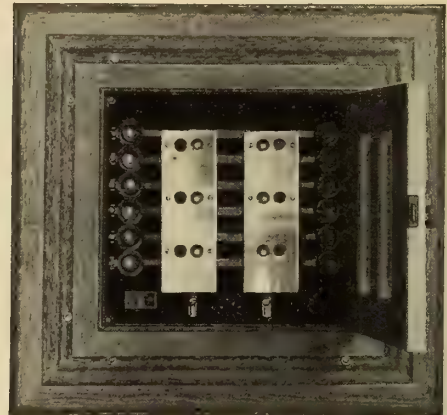
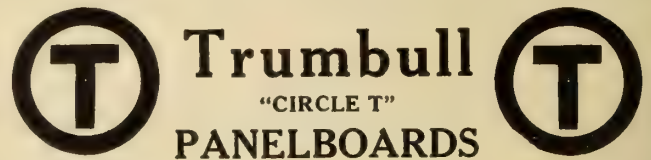
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- 2—10 H.P. Type S T.H.E., 2 phase, 60 cycle, 220 volts, 1800 Rev.
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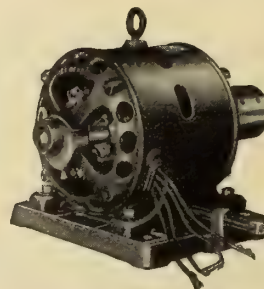
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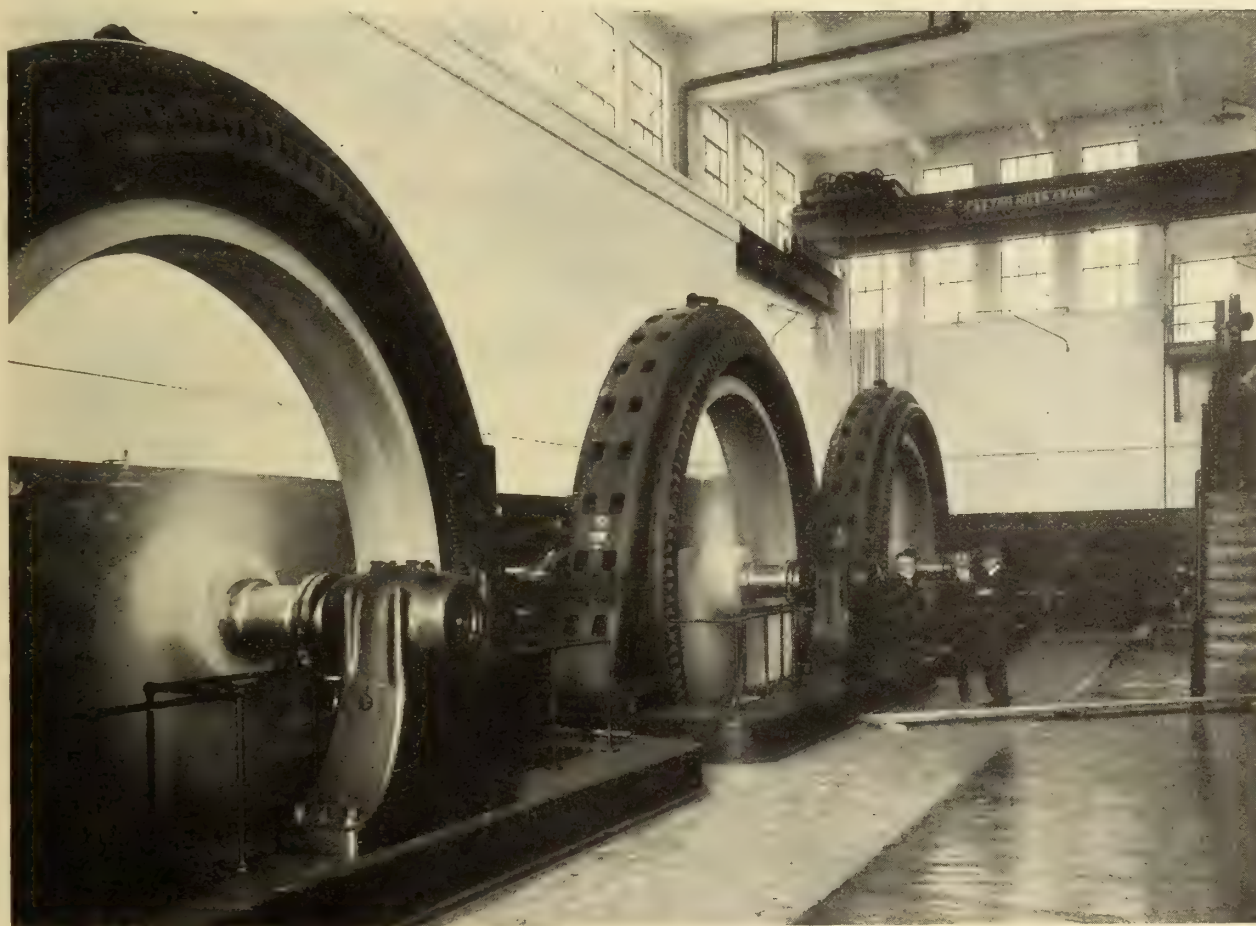


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**The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers**





National Cash Register Co., Toronto. A "GALVADUCT" Building.

**G  
A  
L  
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T**

## "Safety First"

In no thing should the element of "Safety First" be more regarded than in the electric wiring of a building.

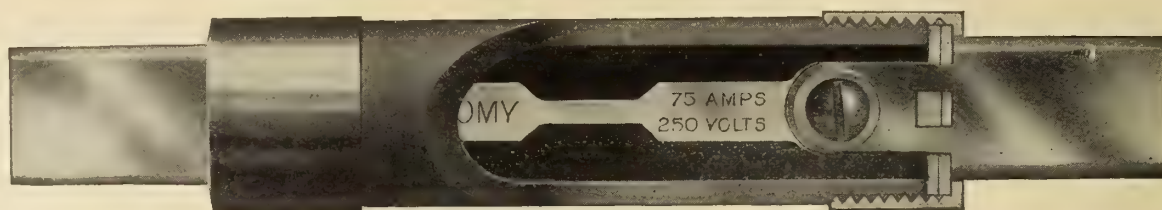
Carry your wiring through "Galvaduct" and "Loricat-ed" and you will always have "Safety First."

**Conduits Company**  
Limited

**Toronto - Montreal**

**L  
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D**





**"Look for the Gray Shell"**

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense over 80 per cent** by using

## **ECONOMY RENEWABLE FUSES**

**They use Economy Renewable Fuses for these reasons:**

**First**, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.

**Second**, because it is the only renewable fuse that is uniformly rated.

**Third**, because it is the only design so far produced that provides the desired electrical characteristics.

**Fourth**, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.

**Fifth**, because they never vent fire or hold a sustained arc and are absolutely safe.

**Sixth**, because they meet the performance specifications governing the use of such devices.

### ***Special Announcement !***

Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

*Write for Bulletin, Prices and Discounts*

## **Economy Fuse & Mfg. Co. of Canada, Limited**

**Herald Building, Montreal**

**ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.**



Installation in New England

**Needless Sub-Station Expenditure  
Kills Economy Practiced at Your  
Power House.**

**Install Outdoor Transformer Sub-  
Stations Equipped with Burke  
Horn Gap Switches, Arresters  
and Fuses.**

**Address Correspondence, Works Office, Greensburg, Pa.**

## **Railway & Industrial Engineering Co.**

**PITTSBURGH, PA.**

**Canadian Representative—**

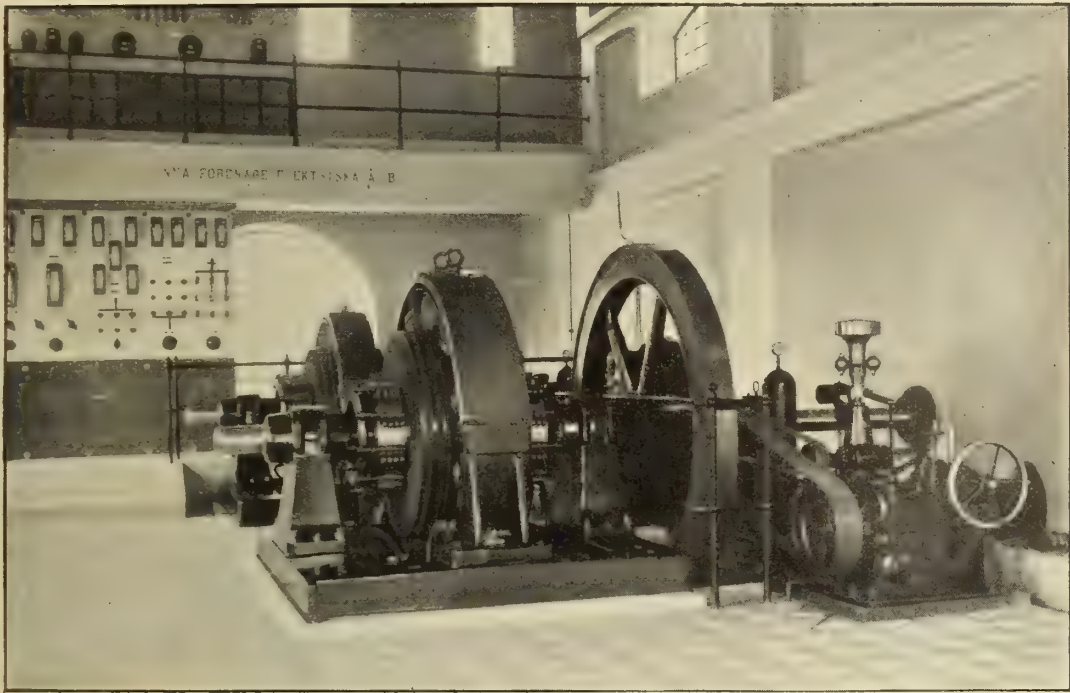
**The Ferranti Electric Co., Toronto**



# Swedish Electrical Machinery

NOTED FOR

## Efficiency and Workmanship



Hydro Electric Plant consisting of two 290 kw., 214 rpm., 220/440 volt, three wire D.C. Generators.

*We solicit your specifications for  
Electrical Equipment*

# BURNHAM ENGINEERING COMPANY

LIMITED

Canadian Dealers for

**The Amalgamated Electric Company of Sweden**

**Head Office :**

**Traders Bank Building, Toronto**

British Columbia Representatives:

Macdonald, Marpole, Co., Limited  
VANCOUVER, B.C.



Montreal Representatives:

**Rudel Belnap Machinery Co., Ltd.**  
Canadian Express Bldg.



Tell the  
Factory Managers  
in Your Town  
about

## *Northern Electric Inter-phones*

Show them how Inter-phones increase efficiency and save time. Explain their simplicity and reliability.

You'll Find  
Ready Sale  
for Them

—and they're a profitable line to push.

You  
push  
the  
button  
and  
get  
your  
man



Write for our Dealer Inter-phone Proposition

# *Northern Electric Company* LIMITED

Makers of the Nation's Telephones

MONTREAL  
HALIFAX  
TORONTO

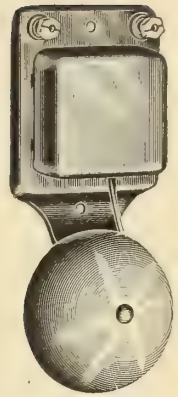
WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA





DIXIE  
Gravity Drop  
Annunciators



DIXIE  
Iron Box  
Bells and Buzzers.

at the  
**PINNACLE!**  
Standard of Electrical  
House Goods For Nearly  
Half a Century.

**T**HERE must be some good reason why 1872 Edwards material is invariably supplied whenever there is a call for electrical house goods of dependable quality.

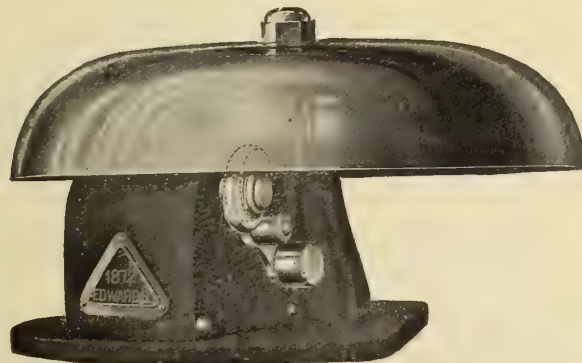
It is because they have a reputation which is based on a manufacturing experience of over forty years. The quality and dependability of the complete Edwards line is unquestioned and unsurpassed.

At each of our distributing houses large stocks are available for immediate shipment.

## "The Riot"

The only  
Motor Bell  
made.

"A Real Ringer"



For loud ringing and general alarm purposes. Operates on battery, or A. C. or D. C. lighting circuit at any voltage for which a motor is made. The rotating arm attached to shaft of motor strikes rapid powerful blows on gong.

### CATALOGUE ON REQUEST

Annunciators; Push Buttons; Switches; Bells  
for every need—"Lungen" Bells and Buzzers.  
5 Sizes, 1 in. to 12 in. All Quality Goods.

### *Northern Electric Company* LIMITED

MONTREAL  
HALIFAX  
TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA



# Crocker-Wheeler Transformers



**A. C. Induction Motors                      Generators**  
**Transformers**

**D. C. Motors for all classes of work.**

A full stock of standard voltage distributing transformers in sizes  
1 to 50 K.V.A. 60 to 25 cycle is on hand for immediate shipment.

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*Communicate with us regarding your Fall and Winter requirements.*

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**THE CANADIAN  
CROCKER-WHEELER CO.  
LIMITED**

**MANUFACTURERS AND ELECTRICAL ENGINEERS**

*Head Office and Works*  
**ST. CATHARINES**

*District Offices*  
**MONTREAL, TORONTO, VANCOUVER**





## Representatives Wanted

Here is a splendid opportunity to handle these tried and tested instruments in your section. For 20 years we've specialized on this class of work and today "Connecticut" instruments are justly famous for their high quality and reasonable prices.

**CONNECTICUT**

### Electric Reset Annunciators and Interior Telephones

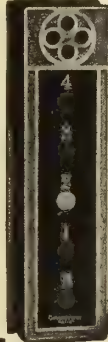
"Connecticut" Annunciators and "Connecticut" Interior Telephones appeal to the user because they are simple in construction, effective in action, look good, wear well and give lasting service.

Made in a wide variety of styles and sizes—each style suited to its particular requirement. You're selling satisfaction—making lasting customers—when you sell "Connecticut" goods.

Write for Catalog 22C and Full Details

Ask us for particulars of our proposition for representatives. Look over our Catalog and note the completeness, reasonable prices and high quality of the "Connecticut" Line.

**Connecticut Telephone & Electric Company, Inc.**  
Meriden, Conn., U. S. A.



## UNIFORMITY!

in mechanical strength, wearing quality, firmness of texture and lubricating quality, **every**

## "LE CARBONE"

(Made in France)

### Carbon Brush

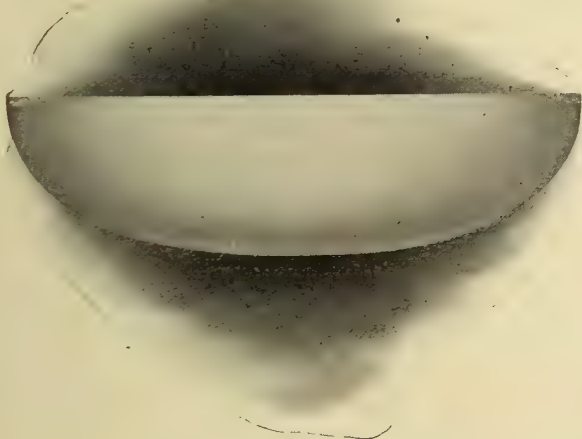
in a million is absolutely identical.

This means that a type of **Le Carbone Brush** once installed to meet your conditions will always meet them on subsequent shipments.

*Le Carbone quality never varies!*

## Rougier Freres Inc.

63 Notre Dame, East  
MONTREAL, P.Q.



Semi Indirect Bowl No. 6056  
Diameter—24 inch

## MOONSTONE Lighting

This new MOONSTONE bowl is specially adapted for use with the Nitrogen Lamp for the lighting of large areas.

The efficiency and diffusion of light obtained is unsurpassed by any other lighting glassware.

## JEFFERSON GLASS COMPANY LIMITED

Head Office & Works  
TORONTO

Branch Sales Offices

{ MONTREAL.  
WINNIPEG.  
VANCOUVER.



# This is a Side View of the Duncan Flush Tumbler Switch



**Pretty Neat, Isn't It?**

Stack it up, in competition, alongside of any of the old push switches or key switches and it will win out every time. In fact the others won't have a look-in for convenience and beauty.

Honestly, People, it's a dandy proposition. It will fit any standard switch box and give you about 50 per cent. more wiring space. Supplied in two or three point styles.

Get a couple as samples and show 'em to your prospective switch customers. We can handle the orders you are bound to get. Gee! we're so enthusiastic over the way it has "taken on" that we'd like to take a dozen of these pages to tell you about it, over and over again. Perhaps we will when your orders begin to come in.

Stocks will be ready August 15th for big or small orders. Place these with your jobber,—he is ready for your say-so. Even though you still have a stock of the old push or key switches which you want to get rid of,—get a sample or two of these new flush tumbler switches to "spring" on your special customers who want the best.

## **The Duncan Electrical Co., Limited, Montreal**

Makers of Electrical Goods of "Duncan Quality" like the above—also a firm getting some more good things ready to show you.





## EFFICIENCY—

—IN CONSTRUCTION AND OPERATION; LIGHT WEIGHT, EASE OF HANDLING AND JOINTING, LOWER CORONA AND INDUCTIVE EFFECTS—ALL THESE AND AN ECONOMY OF THIRTY PER CENT ARE SECURED BY USING ALUMINIUM CABLES.

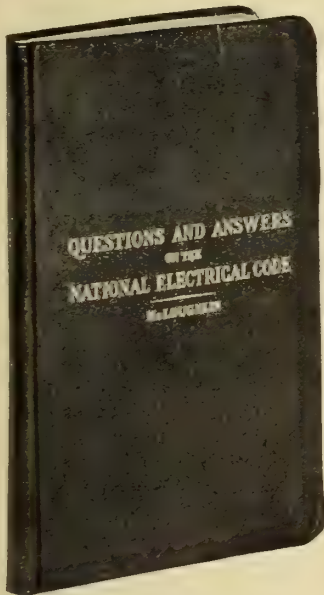
MEET US AT THE EXHIBITION.

**THE BRITISH ALUMINIUM CO., LIMITED**  
(of London, England)

60 W. FRONT ST., TORONTO

## *You Can Interpret the Code Instantly with McLoughlin's*

### **Questions and Answers on the National Electrical Code**



It tells at once the answer to the questions on code requirements. Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.

Every question is carefully indexed so that you can locate the fact you are after instantly.

Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.

Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible

Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.

The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding \$1.00 net, prepaid.

*For Sale by*

**Electrical News,**

**220 King Street West, Toronto**

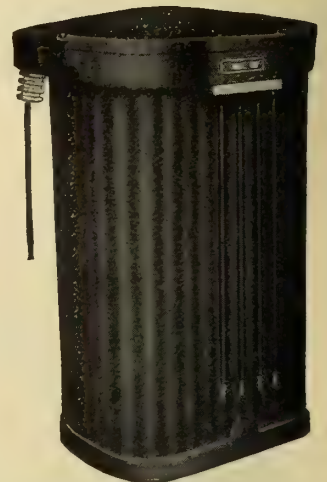




1 to 15 K. V. A.

# Moloney H. E. Pole Type Transformers

**Quick Shipments**



20 K. V. A. and larger.

## Moloney Electric Company of Canada, Limited

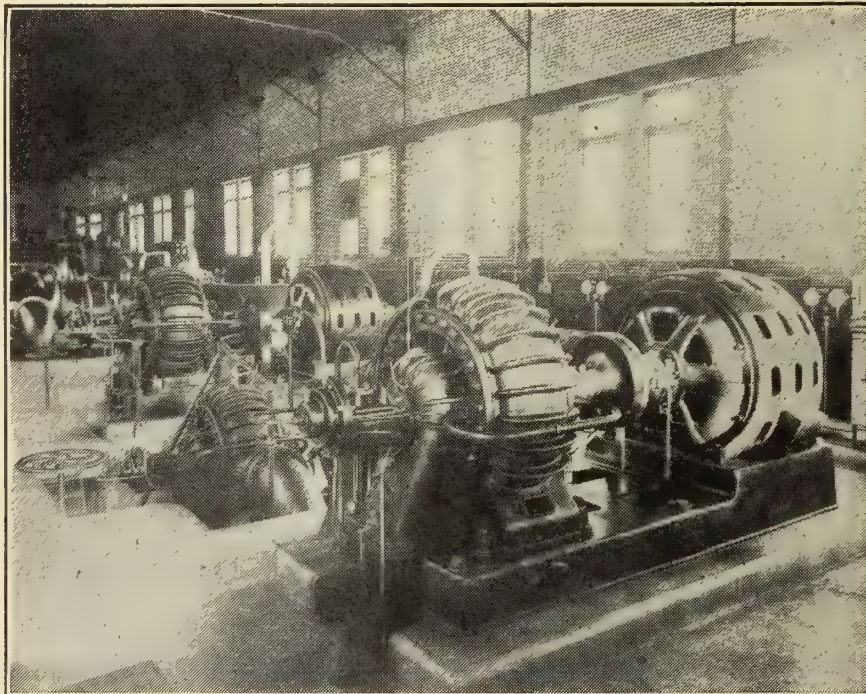
WINDSOR, ONTARIO

Factories at Windsor, Ont. and St. Louis, Mo.

901 Electric Railway Chambers, Winnipeg, Man., Can.  
1001 C.P.R. Building, Toronto, Ont., Can.

401 Lake of the Woods Building, Montreal, Quebec, Can.  
221 Rogers Building, Vancouver, B.C., Canada

Complete Stocks at WINDSOR, WINNIPEG, VANCOUVER



Three 10,000,000 Gallon Pumps against 200 lbs. pressure supplied to the Montreal Power & Water Co.

## High Efficiency Water- works Pumps

One of the pumps shown in the picture was installed by us two years ago and we have since installed the other two shown in the same picture.

*Repeat Orders  
Speak For  
Themselves*

## BOVING & CO. OF CANADA, LIMITED

TORONTO

VANCOUVER

Works LINDSAY, ONT.





## "More Electric Light"

for cities, factories, store-rooms—everywhere, is the demand to-day. The link between your supply and this demand is your electric cables. The efficiency and reliability of the whole system, the success of your business, depends on this link.

### STANDARD Cables and Cable Accessories

are the result of over 30 years' experience in the manufacture and installation of high grade products of this kind. This experience has taught us that it is in the end better business policy to sell products that give durable and dependable service rather than, by reducing quality and cost, to secure increased sales.

*If you are interested in such service you can get further information about STANDARD Products by writing our nearest office.*

### Standard Underground Cable Co., of Canada, Limited Hamilton, Ont.

Montreal, Que.

Boston, Mass.

Seattle, Wash.

Winnipeg, Man.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Accessories.

## LAST-MINUTE CALL FOR FANS

We have a complete stock of electric fans in all types and sizes for immediate shipment. Sorting orders for one or one dozen will be given prompt attention and you can rely on immediate shipment.

## "CONDOR" LAMPS

**The Lamp With The Good Reputation**

*Write us about your fall stock. Get the terms of our special contract forms.  
Let us have your orders now.*

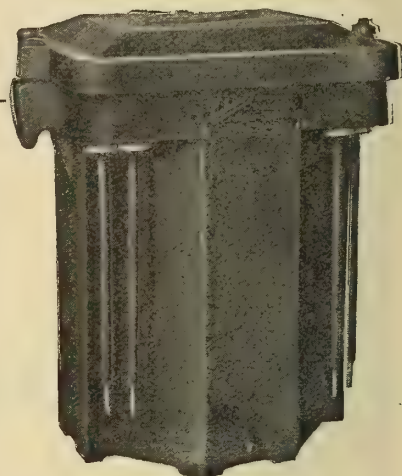
Many of our customers were disappointed last year by not placing their orders in advance. If you were one of them obviate this trouble by placing your orders NOW.

**Sole Canadian Distributors**

# C. H. Basters & Company

22 College Street, TORONTO, ONT.

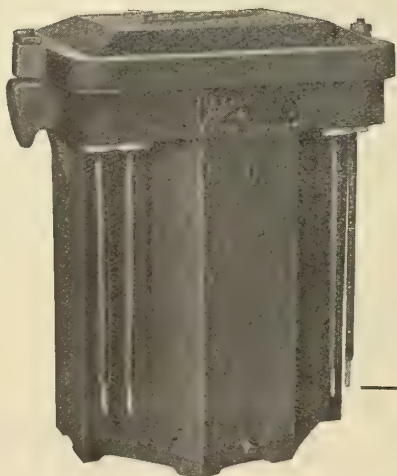




*Packard*

**DISTRIBUTING TRANSFORMERS**  
FOR  
**POWER and LIGHT**

Packard Transformers are designed to insure the highest efficiency in continuous service to the user. The superior quality of material and strong and rigid mechanical construction will effect a large saving in one year over ordinary transformers. It is the low cost of maintenance which makes the "Packard" so economical.



The **Packard Electric Co., Ltd.**

Factory at St. Catharines, Ont.

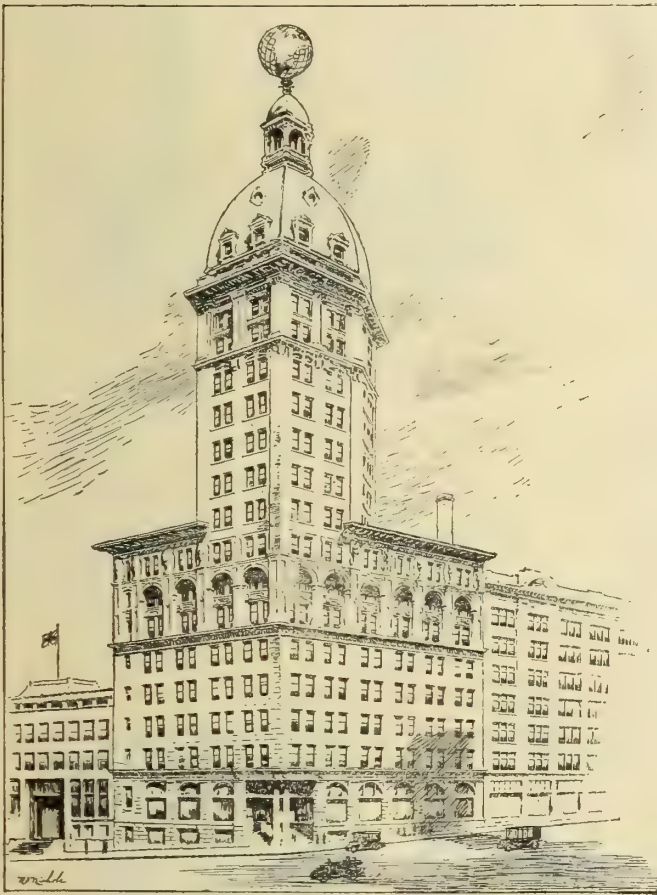
General Sales Office, N. W. Office and Warerooms  
Traders Bank Bldg., TORONTO WINNIPEG

LARGE STOCKS CARRIED AT

St. Catharines and Winnipeg; St. John Railway Co., St. John, N. B.;  
General Supplies, Limited, Calgary, Alta.;  
Rudel-Belnap Machinery Co., Canadian Express Building, Montreal, Que.



# Across Canada with the IMPERIAL WIRE & CABLE CO. LIMITED




---

Seventh of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire & Cable Co.'s, Limited, wires.

---

*This picture shows the World Building, Vancouver.*

This Building was wired with  
"Adanac" Rubber Insulated Wire

Architect	-	-	-	-	W. T. Whiteway, Vancouver
Engineer	-	-	-	-	W. E. Hughes, Vancouver
Electrical Contractor	-	-	-	-	J. G. Sutton, San Francisco, Cal.

## *Northern Electric Company* LIMITED

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver Victoria  
Successors to IMPERIAL WIRE & CABLE CO., LIMITED.

Correspondence previously addressed to Imperial Wire and Cable Co., Limited, at 611 C.P.R. Building., Toronto, and 902 Electric R. Chambers, Winnipeg, should now be addressed to the Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg.



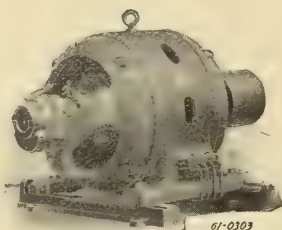
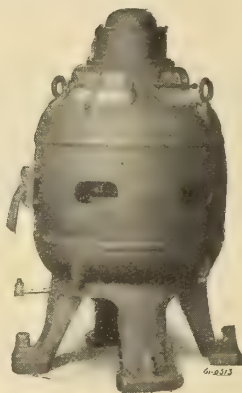
## Your Production

will never cease at a critical moment if you install

**Wagner, Quality**

## Single-phase Motors

They have a well established reputation for reliability.



Bulletin 10113

**Wagner Electric Manufacturing Company**  
of Canada Limited—Montreal

57 Guardian Bldg.,  
Montreal

1222 Traders' Bank Bldg.,  
Toronto

## Here It Is RAPID TOAST-STOVE

TO RETAIL AT \$2.50



Can you beat it at the price?

Immediate Shipment. Standard Package 25.

Liberal Discounts.

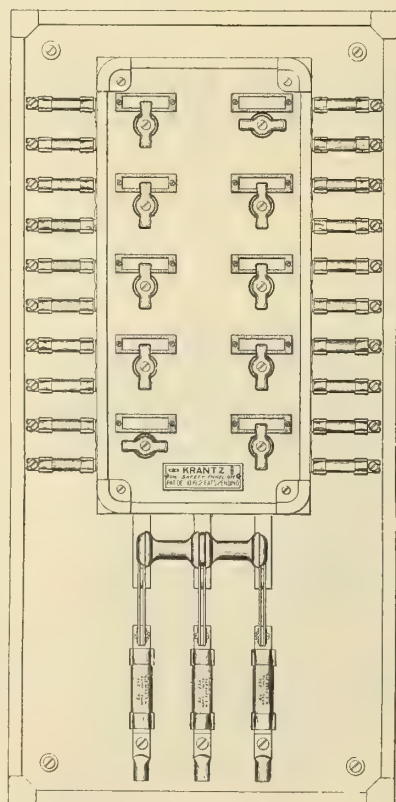
Complete with Hubbell Attachment Plug.

**R. E. T. PRINGLE**

901 New Birks Bldg.  
MONTREAL

308 Tyrell Bldg.  
TORONTO

150 Princess St.  
WINNIPEG



Krantz Safety Panel  
Without Trim

On the Largest Installations in  
Canada You Will Find the Name

# KRANTZ

on

## Panelboards and Switchboards

*We Manufacture*

Safety Panels, Metering Panels, Knife Switches, Switchboards of Standard and special designs.

The closest examination will convince you that our product is equalled by none although copied by many.

We are recognized leaders in switchboard and panel design and our engineers are at your service.

*Write for catalog No. 34, Jan., 1914.*

**The Canadian Krantz Electric  
and Mfg. Co., Limited**

Head Office—67-71 Adelaide St. West, TORONTO

Branch Offices—Montreal, Winnipeg



## J-M Jomanco Friction Tape

**Prevents Fire  
Loss From  
Defective  
Inside Wiring**



**D**EFFECTIVE joints are the origin of most electrical fires that destroy hundreds of lives and thousands of dollars' worth of property annually. This heavy fire loss can be prevented, in large measure, by taping all joints on inside wiring with J-M Jomanco Friction Tape.

J-M Jomanco Tape, mechanically and electrically, prevents sparking conditions at the joints by reinforcing and insulating them with a closely woven fabric, each thread of which is heavily and evenly saturated with a special insulating compound that does not dry out.

Owing to its great adhesive properties and long life, Jomanco stays where it is wound, regardless of moisture, heat and weather conditions. It comes in 1, 2, 4 or 8-ounce packages,  $\frac{3}{4}$ -inch wide.

Write our nearest House for sample and special prices to the trade.

## J-M Alpha Rubber Tape

**Makes  
Out-Door  
Joints  
Watertight**



**S**HORT-circuits and "grounds," due to poorly insulated joints on high tension, overhead and underground lines, can be prevented by using J-M Alpha Rubber Tape.

This tape insures permanently watertight joints of great mechanical and dielectric strength because it is made of pure Para rubber so compounded that it does not dry out. Without the aid of heat, a joint or splice covered with J-M Alpha Rubber Tape becomes one homogeneous mass of rubber.

J-M Alpha Tape comes in 8-ounce packages  $\frac{3}{4}$ -inch wide. Remember the name—Alpha.

Further information may be had from our nearest House.

### THE CANADIAN H. W. JOHNS-MANVILLE CO., Limited

Manufacturers of Service, Subway and Transformer Boxes; Fuses; Line Material; Insulating Materials; Fibre Conduit; Fireproof Wood; Friction Tapes; Dry Batteries; Lighting Systems; Etc.

**TORONTO**

**MONTREAL**

**WINNIPEG**

**VANCOUVER** 1816



## Shipments on National Ranges can now be made

If you haven't ordered a sample yet, get our interesting prices and order.

Let the merits of our new line present themselves.

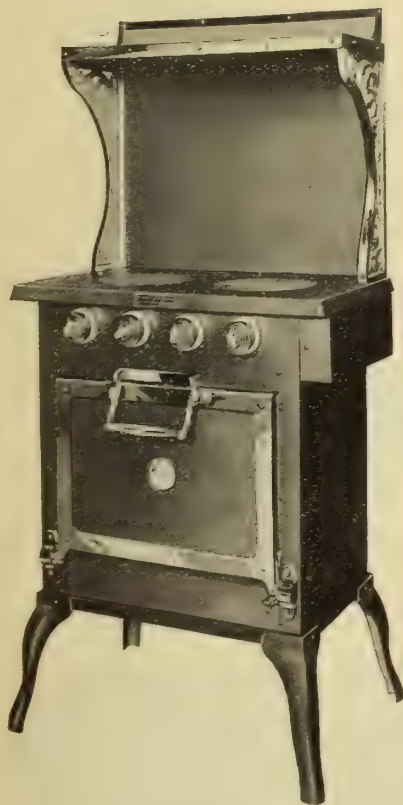
Our New Line comprises

**Ranges (Two Models)**

**Portable Ovens**

**One and Two Disc Hot Plates**

**The National Electric Heating Co.**  
TORONTO, CANADA **Limited**





**S**UCH discriminating care is used in the selection of raw materials from which CANADA wires and cables are made, and such extreme vigilance exercised during the course of manufacture that we are able to say that whenever you buy this well-known brand **you can't go wrong.**

Get our quotations on—

Transmission Cables Copper and Aluminum.

Weather Proof Copper and Aluminum Line Wire.

Rubber Covered Wires and Cables.

Railway and Power Feeder Cables in Copper and Aluminum.

Copper Trolley Wire.

Copper Clad Wire Bare and Weather-proof.

Telephone and Telegraph Wire Bare and Insulated.

Galvanized Steel Strand Guy Wire.

Prompt shipments made from stocks carried at Toronto, Montreal, Winnipeg and Vancouver.

**Canada Wire & Cable Co.**

Limited

**Toronto** 1170 Dundas Street **Ontario**

*Sales Offices :*

401 Lake of the Woods Bldg.  
Montreal, Que.

A. E. Esling, 150 Princess St.  
Winnipeg, Man.

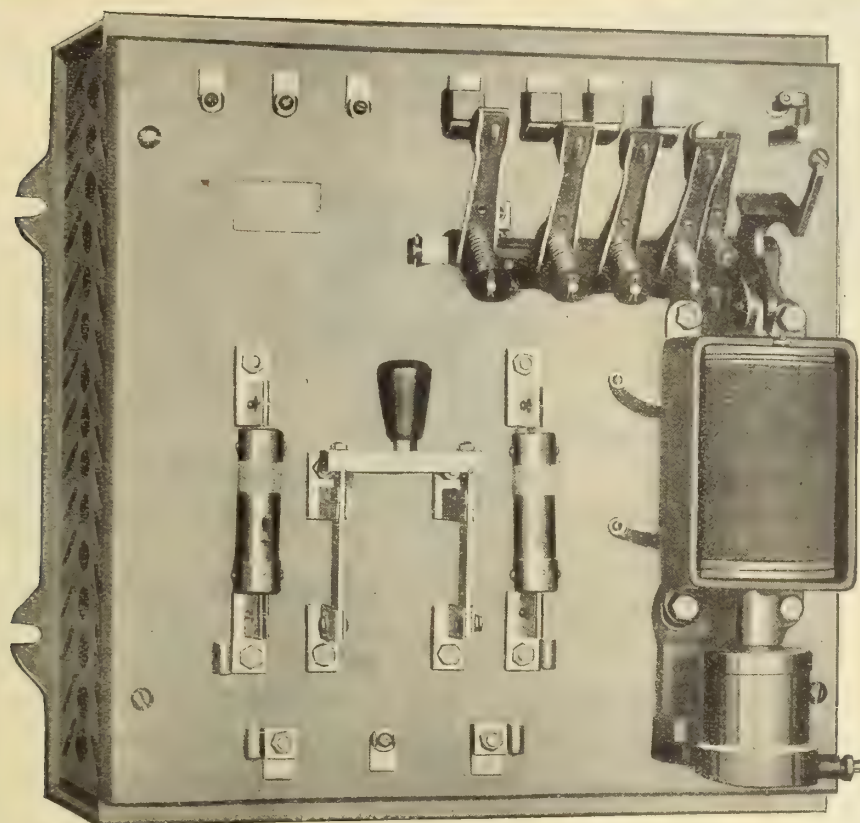
Macdonald, Marpole Co., Ltd., 427 Seymour St., Vancouver, B. C.

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# CUTLER-HAMMER

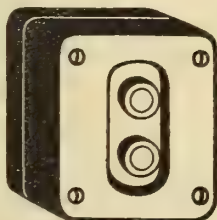


## Start Your Motors Automatically

The solenoid-operated multiple finger type motor self starter acts positively—is simple, sure and extremely durable. The starting action is not affected by load variation, but is positive every time.

These automatic starters are particularly adapted for use with pumps, compressors, fans, machine tools, vacuum cleaning systems or wherever remote or automatic control of the starting and stopping of an electric motor is desired. The operation may be controlled by push buttons, knife switch, float or tank switch, or pressure regulator.

Booklet containing Bulletins on Automatic Starters sent promptly on request.



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We have made push-button controllers for fifteen years, for all classes of service. If you wish to control any kind of motor-driven machine from push-button stations put your problem up to Cutler-Hammer.

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NO LEAD. NO ACID. NO CELLULOID CASE

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Cannot be hurt with overcharging or running down to Zero.

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There is in a certain factory a display of Circuit Breakers of all makes, I-T-E "and others."

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Such competition is not in accordance with the spirit of the times—with the idea of a square deal.

When a big competitor uses such small methods their case must indeed be desperate.

The proper place to get the facts on I-T-E CIRCUIT BREAKERS is from

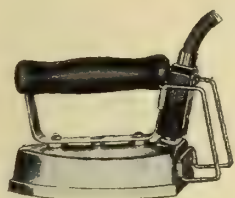
## **THE CUTTER CO., Philadelphia**

P. S.—We will be glad to sell this competitor a complete line of up-to-date apparatus for purposes of comparison on the same terms as we sell them I-T-E Circuit Breakers for their exacting customers.



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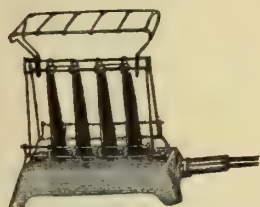
FLAT IRON  
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With porcelain base.

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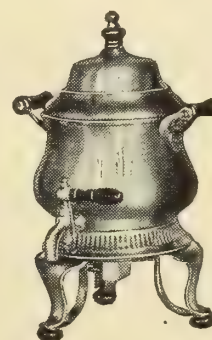
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They are neat in appearance, run easily, sell quickly and give least trouble.

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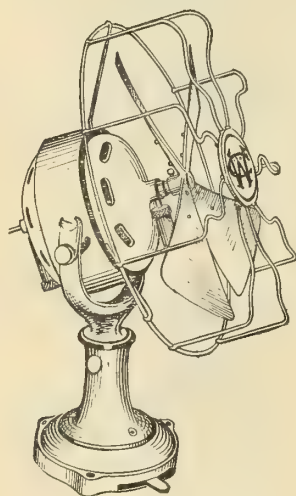
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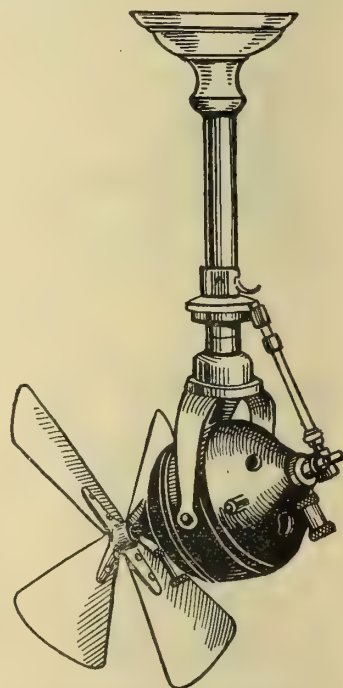
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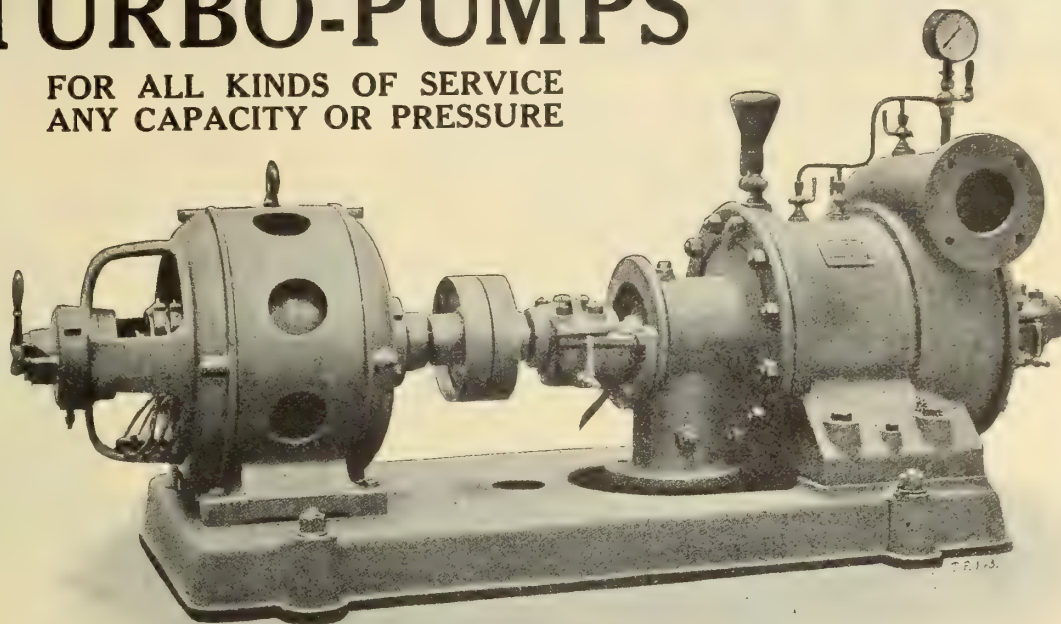


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FOR ALL KINDS OF SERVICE  
ANY CAPACITY OR PRESSURE

Highest  
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## SUNDH SOLENOID MOTOR STARTERS

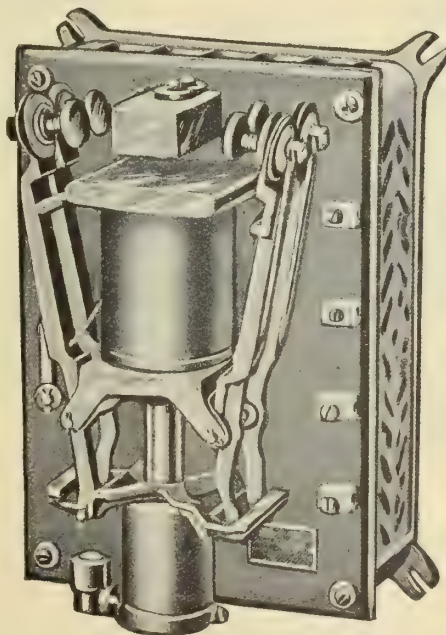
Compact and reliable starter for Direct Current.

No sliding contacts.

The advantages of this type of construction are not only simplicity and easy replacement of wearing parts, but also the elimination of sliding contacts which cause trouble due to arcing and consequent sticking of the moving member.

The construction of the Sundh Automatic Starter is compact and simple, consisting of a solenoid, a plunger with retarding dash-pot, and two or more levers hinged to the lower pole-piece of the solenoid.

Send for illustrated Catalogue on  
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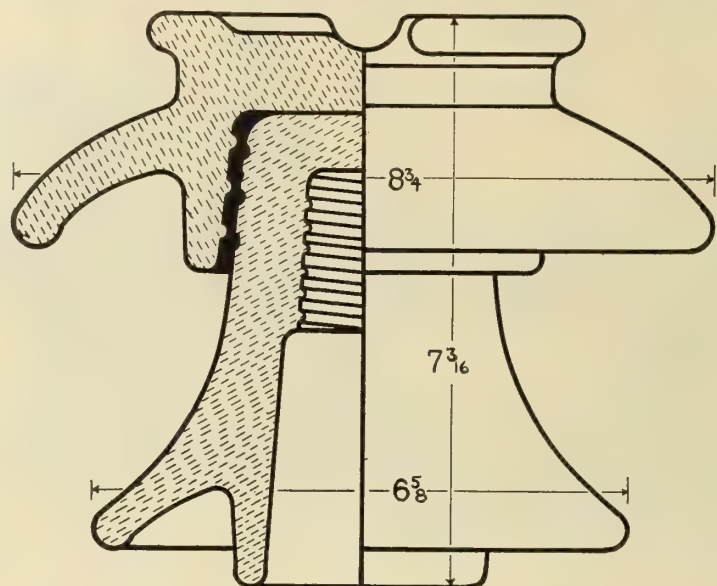
The upper ends of the levers carry the contacts. The levers are controlled by their lower ends passing through a frame which is attached to the bottom of the plunger. The contacts are of copper and carbon, and all wearing parts are accessible and easily replaced. For heavy duty the final contact is made by a laminated copper brush. This copper brush, however, does not cut out any resistance, but merely short-circuits the carbon contacts which do cut out the resistance.

**Sundh Electric Company**

**New York, U.S.A.**



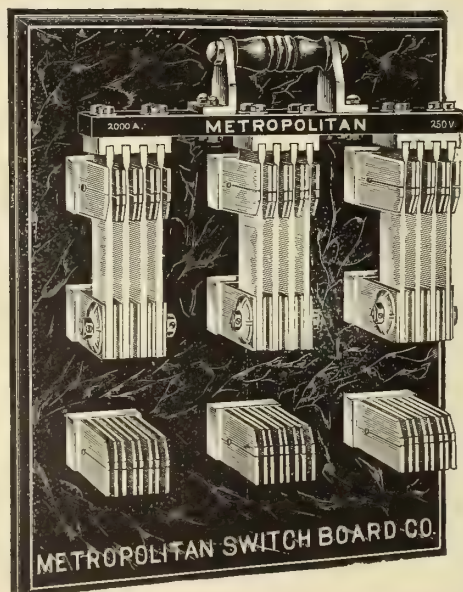
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Number	133
Line voltage	30,000
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Leakage distance	17 3/4-in.
Pin hole	1 3/8-in.
Net weight	10 1/2-lbs.
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TRADE **METROPOLITAN** MARK  
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Panelboards, Switchboards  
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Eyes must be protected from the blinding brilliancy of the "Nitrogen lamp."

A most effective way of doing this is to conceal the lamp, and, by means of powerful X-Ray Eye Comfort reflectors direct the light against the ceiling at the proper angle, and evenly diffuse it throughout the room.

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Without perfect control of the light rays, searchlights, auto, and locomotive headlights, etc., would be impossible.

Some of these accomplish light control by means of a lens, others use correctly designed mirror reflectors. You never see anything but a mirror reflecting surface used in any of these light is so essential,—never steel, never plaster or wood. is the only surface which re-against it at exactly the same surface, (see figure 1). This flection.



Instead of reflecting rays at the same angle, the light rays are "sprayed" back, so to speak, the light being reflected at all angles. This diffusely reflected light does not travel in any single fixed direction and it cannot therefore be controlled.

All X-RAY Eye Comfort Reflectors are mirror Reflectors designed in strict accord with this first law of light.

Write for information on nitrogen lamp fixtures.

## National X-Ray Reflector Company

"Illumination from Concealed Sources"

Chicago  
225 W. Jackson Blvd.

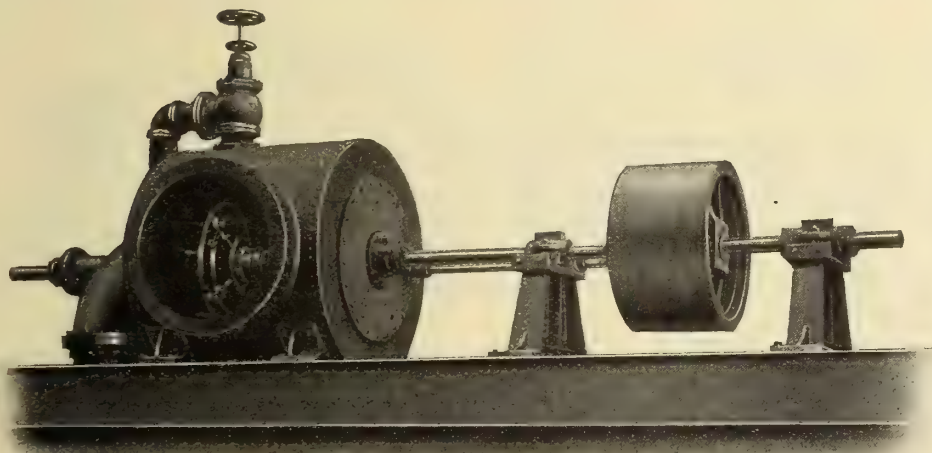
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## The Canadian Turbine Water Wheel

Stands to-day as the only safe investment for the man with a limited supply of water and varying conditions of head.



Single Horizontal, Steel Case with Relief Valve

Supplied to

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**Horizontal Shaft and Vertical Shaft Turbine Units**

*of every design*

**CHAS. BARBER & SONS, Meaford, Ontario**

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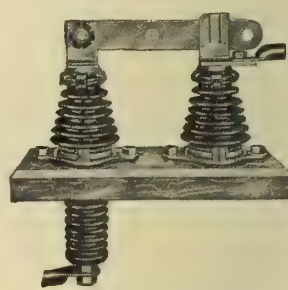
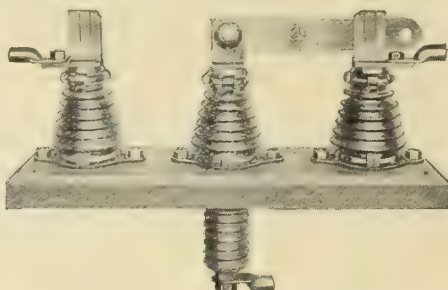
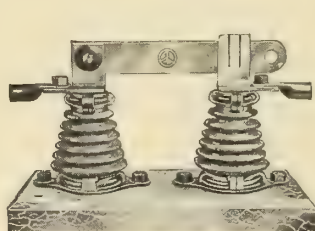
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## DISCONNECT TYPE SWITCHES

Built for Any Voltage and All Capacities

Arranged for mounting on flat base or pipe frame or compartment or on panels. Also with lock device. All studs and clips from copper forgings.



All porcelain of wet process glazed all over and we guarantee test of  $4\frac{1}{2}$  times above service voltage. The base clamps are made of malleable or bronze metals, and are always bronze on back connected switches.

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If your jobber does not carry a stock—write us.

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**The Unbreakable Kind**

*Are Now Ready for Delivery*

We guarantee delivery to you in good condition

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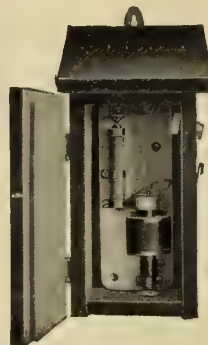
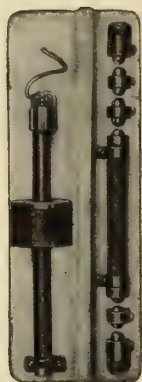
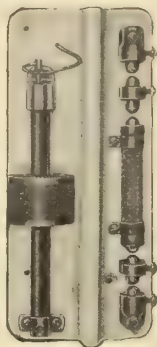
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# You Must Use These Lightning Arresters



Arresters for A. C. Service 1200 to 2500 volts.

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## To Get Complete Protection

Only Garton-Daniels Lightning Arresters can offer you "complete" protection. Their small air gap distance, low series resistance and positive mechanical circuit breaker insure efficient protection, eliminate low voltages, winking lights, etc., and make grounds and short-circuits through the arrester next to impossible.

Don't forget that one flash can cripple your entire plant—cost you a lot of money—loss of power—kicks from the public.

Your apparatus is not protected without Garton-Daniels. Order yours now before the lightning comes.

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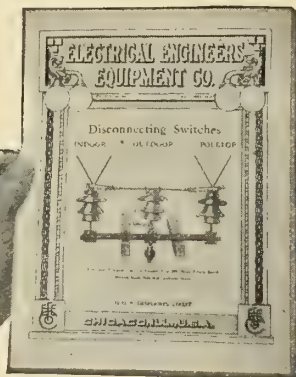
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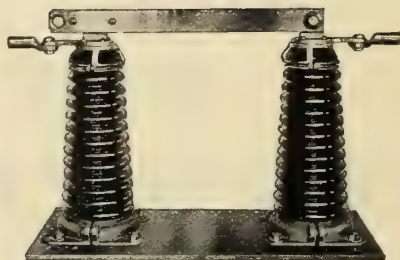
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Manufacturers  
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Design, construction, operation, delivery and price is Right.

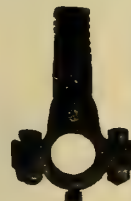
Write our nearest Agent.  
Suitable Designs for any special conditions.  
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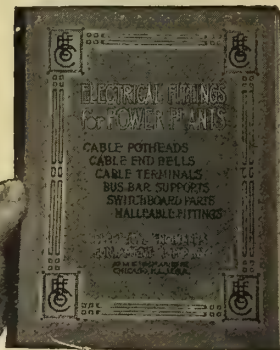
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*Northern Electric Company*  
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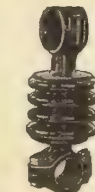
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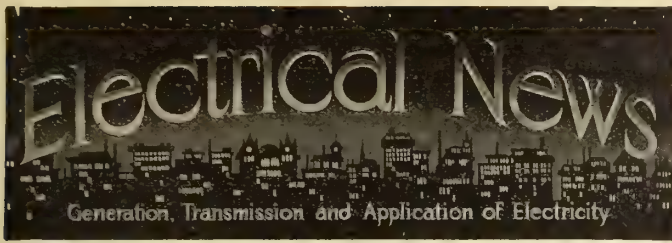
You will find the data, tables and general information of decided value.



Write for this catalog.







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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for \$2.00 per annum. United States and foreign, \$2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 23

Toronto, August 1, 1914

No. 15

## Overhead Line Construction

A most valuable report was presented by the Committee on Standardization of Overhead Line Construction at the recent convention of the Canadian Electrical Association. This report covers all voltages up to and including 35,000 using wooden poles only. The value of the report depends very largely on the drawings which accompany it and which indicate the recommended standards much better than any description, however lengthy, could do. While the committee places itself on record as being opposed to too strict a standardization, they have very fully outlined a system of construction which might well be followed within very close limits. Indeed, many of the illustrations represent equipment that has already been standardized by a number of the larger companies.

Among the benefits to be derived from standardization it is mentioned that the costs of manufacturing would be less; that it would not be necessary to carry such large reserve stocks; that this also would assist the small jobber whose capital may not be sufficient to carry a complete stock of all the various fittings and who with the smaller stock would be satisfied with a closer margin of profit; and that the customer benefits in being able to obtain his fittings more readily and without the necessity of carrying a large stock himself. It may be added that the ultimate consumer might benefit to a considerable extent by reduction in overhead expenses all along the line which in itself is a consideration worth noting.

We believe this is one of the most valuable reports ever prepared on this subject and are glad to be able to reproduce it with the very complete set of drawings which accompany it, on other pages of this issue. We know that every sugges-

tion made in this report is the result of actual, tried experience and central stations and others may safely accept them as certain to produce thoroughly safe and satisfactory results.

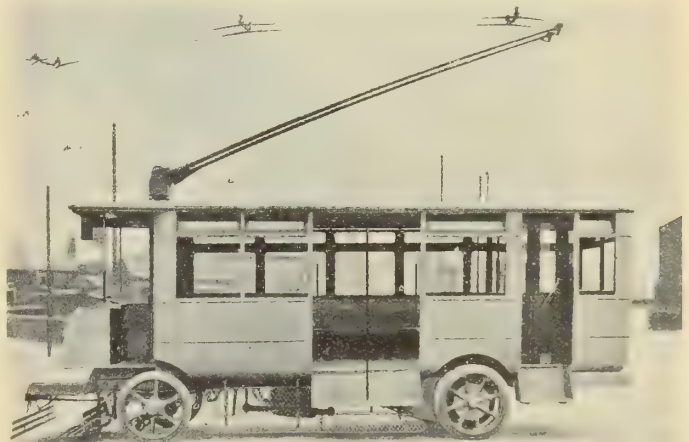
## Present Status of Prime Movers

The Committee on Prime Movers recently made a report to the American Institute of Electrical Engineers on the present status of the various types of prime mover equipment at present available. The report covers the reciprocating steam engine, the gas engine, the steam turbine, the oil engine and finally the hydraulic turbine, treating each separately as to its cost, efficiency and the field to which it is best suited.

According to this report the reciprocating steam engine has become practically obsolete for use in modern power stations. The steam turbine is placed at the head of the list of prime movers. The possibility of using natural gas and blast furnace gas has greatly enlarged the field of the gas engine; in addition the fact that fuel can be obtained either from coal, coke, lignite, peat, wood, oil or other kindred fuels has resulted in the very general use of this type of engine. In Europe the Diesel engine has made considerably more progress than on this continent; under favorable conditions the cost of operation is very low but in the larger capacities the weight of the engine increases unduly and, consequently, its size is out of proportion to the increase in capacity, so that the limiting value for this engine is somewhere in the neighborhood of 2,000 kw. Respecting hydraulic turbines the most important development has been the increase in efficiency which now runs in the neighborhood of 90 per cent. This is true not only at full load, but for a wide range of fractional loads. The report notes the trend towards the single runner, vertical shaft type of turbine for low and medium head and mentions the Keokuk plant. Reference might also have been made to the Cedars Rapids development where this type of turbine is being used and where, we understand, the largest units in the world to date are being installed. The article is very fully illustrated by curves which indicate the operating efficiencies and cost of the various types discussed. We reproduce these with the article complete on other pages of this issue. The paper will, we believe, stand as the best available reference on the subject of prime movers for some time to come.

## Trackless Electric Cars

The favorable reception that has been accorded the trackless trolley car in the British Isles has resulted in a number of recent improvements in the design of this type



Latest type trackless trolley car.



of car, which appear to have removed many of the original objectionable features. The latest type approaches more nearly to the standard rail car of the present day, being equipped with a front safety guard, low steps, centre entrance, etc. The floor of the latest design of car has been brought down as near to the roadway as possible so that only one step is now necessary to reach the deck. The car has two compartments, and the entrance to each is at the side. A life guard has been fitted in addition to the customary wheel guards, and from tests made in the usual way with dummies, very satisfactory results are claimed to have been obtained. The improvements in design of this latest car have also resulted in increased accommodation with reduced weight. The car is driven by two 28 h.p. motors, each geared to a rear wheel. The lower cost of construction and the flexibility of the system, which allows the car to operate on any kind of a roadway where the trolley wires have been installed, are making this type of vehicle very popular in less thickly populated districts. For conditions obtaining in some of the suburbs of Toronto at the present time, as well as possibly in other Canadian towns and cities, a car of this type would appear to offer a very satisfactory solution.

### The Late Dean Galbraith

Graduates of the "School" have heard with profound regret of the death of their much beloved Dean on the morning of July 22 at his summer place on "Go Home Bay."

For nearly fifty years Dean Galbraith has been the moving and guiding spirit of the School of Practical Science, now the Faculty of Applied Science & Engineering of the Uni-



Dr. John Galbraith.

versity of Toronto. Indeed, Dean Galbraith and the school have been so inseparably associated that it is impossible yet to think of his place being taken and his work carried on by another. It is safe to say that the University of Toronto have rarely been confronted with a more difficult task than the choice of a successor.

The life history of Dr. Galbraith is so well known, not only to students of engineering but to practically every lay-

man from one end of the Dominion to the other, that it seems superfluous to add anything at this time. The graduates who were fortunate enough to be able to attend on the occasion of the celebration of the Dean's 50th anniversary of his entrance to the university as a freshman, which was held on December 5 of last year, will now count themselves doubly fortunate. This occasion now appears more than ever a fitting climax to a long life of resourceful and productive effort towards the betterment of engineering conditions in Canada. Dean Galbraith will ever be remembered by the graduates of Toronto as the man who placed the Engineering Faculty of the University of Toronto on a par with the best the universities of the world have to offer.

### Electric Drive in Lumber Mills

In British Columbia, where the lumbering industry is of paramount importance, the application of electric drive to lumber mills has the close attention of mill owners, the electrical engineering profession and supply companies.

The most recent instance in this province of electric drive being adopted for this purpose is at the McLelan Lumber Company's new mill, situated at Ladner, about 12 miles due south of Vancouver, which commenced cutting last March. The plant, which has a daily capacity of about 125,000 feet, and provides employment for a mill crew of 100 men on an average, occupies a site covering 10 acres on the South Arm of the Fraser River. Steam as well as electric power is utilized, the planing mill being operated by electric drive, while the sawmill is driven by steam.

The sawmill power house is a cement structure 40 x 48 feet in size. It contains a battery of three 72-in. x 18 ft. return tubular boilers, each carrying 160 lbs. pressure. The boilers, which were manufactured by the Vulcan Iron Works, New Westminster, have "Dutch Oven" settings and are fed automatically from overhead.

The engine room adjoining, built of cement and brick, is 44 x 40 ft. in size. In it is a pair of Lane & Bodley Company twin engines, 17 x 24-in., capable of developing 600



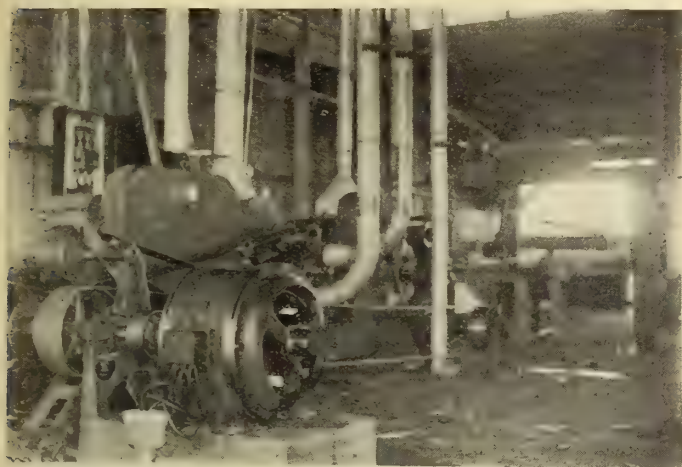
Direct driven machine in McLelan Lumber Company's plant, Ladner, B. C.—showing motor and starter.

h.p.; also a Worthington pump 10 x 6 x 10-in., capacity 500 gallons per minute, which is being used for fire protection for the time being.

The planing mill is 40 x 60 ft. in size, with cupola roof, there being two 24 ft. overhang additions on the north and south sides; on the east side is the grinding room, 16 x 40 ft. The equipment of machines comprises one Berlin No. 91 fast feed planer; one Berlin No. 108 inside moulder; one Berlin self-feed rip saw; one 60-in. Mershon resaw; one 48-in. three-drum sander; and four swing cut-off saws. All machines in the planing mill are driven by individual motors



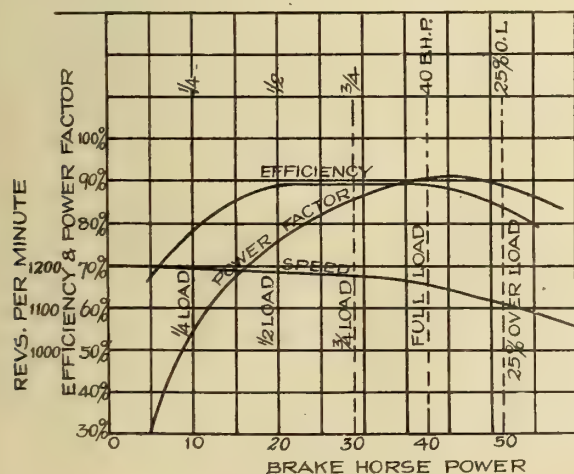
varying in size from 1 h.p. to 50 h.p., three of the motors being direct connected to the driven machines. Electric current is furnished by the Vancouver Power Company, a subsidiary concern of the B. C. Electric Railway Company, the pressure being 220 volts, 3-phase at 60-cycles. The blow-piping system serving the machines was installed by Feix Company, Vancouver. It collects the shavings and sawdust



Another view of direct connected machine in McLelan Lumber Company's plant, Ladner, B. C.

from each and delivers same through a long pipe to feed the boilers in the sawmill power house. The system is equipped with a double 55-in. Sheldon fan, electrically-driven, and installed in such a way as to work very economically in consumption of current.

Lumber cutting being fairly intermittent and varying in proportion to the size of the cut, a problem of interest to the mill owners is—after ascertaining the size in B.h.p. of the motor required—to find a motor having a long range of efficiency around the normal load of the motor. In such a choice there is much money to be saved. The accompanying set of curves for a 40 B.h.p. motor at the McLelan Company's mill shows the efficiency between  $\frac{1}{2}$  load and full load to be nearly a straight line, while the efficiency at  $\frac{1}{4}$  load is 79 per cent and at 25 per cent overload 84 per cent. At the same time this set of curves demonstrates the fact that a motor must not be overloaded to any great extent if the lumber to be cut is to be a paying proposition. Very often one or more overloaded motors eat up the cost of the purchase of larger



High motor efficiency over wide range.

motors, the mill owner not being aware of the actual loss, as the current bill is spread over a number of motors and a number of cuts of varying sizes.

Another feature of the electric installation at Ladner is the "fool proof" starting devices. The starting handle cannot

be thrown into the "running" position without first engaging with the "start" position. A time lag or slow motion device compels the operator to hold the handle in the "start" position for the predetermined length of time; any premature attempt to engage with the "running" position merely brings the handle to the "off" position. The starters are also fitted with "no-volt" and "overload" circuit-breakers which bring the starting handle to the "off" position in cases of failure of supply or overload. The overload breakers being in circuit in the "running" position only, can be set at a load to protect the motor and at the same time save fuses.

The smaller motors from 25 B.h.p. down are fitted with ball-bearings and require no lubrication for periods of twelve months and upwards. The standard of temperature adopted is 72 deg. Fah. (40 deg. Cent.) when running continuously at full load.

The motors in the planing mill of the McLelan Lumber Company were supplied and connected by Messrs. P. E. Harris & Company, Limited, Vancouver, who are the agents in B.C. for the makers, Messrs. Harding, Churton & Company, Limited, Leeds, England. The electrical department of Messrs. P. E. Harris & Company, Limited, is under the management of Mr. W. W. Fraser.

## Training Telephone Operators

With a view to securing as perfect a service as possible the B. C. Telephone Company devotes a considerable amount of attention to the training of its operators, the success attained in this direction being clearly demonstrated by the steadily decreasing number of complaints, notwithstanding the constant growth of subscribers. About two years ago the company established a training school for operators in a building adjoining its Fairmont exchange at Vancouver and maintains there all the equipment necessary to enable the prospective operator to become thoroughly familiar with her work.

In the first place after careful selection of candidates, attention is paid to pronunciation and enunciation, a teacher of elocution being retained for this purpose. Other of the chief points to which particular emphasis is given in the course of instruction are promptness, accuracy and courtesy.

The equipment at the training school at Fairmont ensures practise on calls of all types. It consists of six "A" operating positions and a monitor's desk of two positions. Three of the "A" positions are of the multiple type and three are of the ancillary type. There are twenty answer jacks, and those being utilized represent all classes of tele-

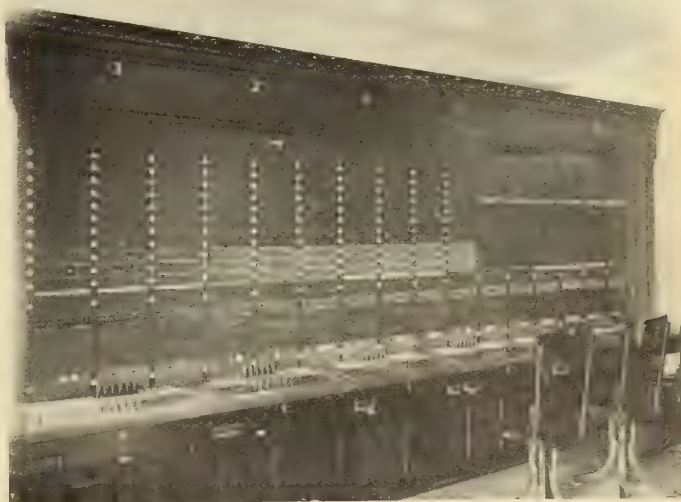


Fig. 1—Front of switchboard.



phone service, including the two different kinds of pay stations, the coin-box, measured rate, flat rate, and individual and party lines. The working lines are scattered throughout the multiple so that an operator in reaching for them becomes familiar with locations throughout the switchboard.

The monitor positions are so equipped that the monitor can first act as the originating subscriber, and place a call. She is then able to be the "B" operator on either ring down or call circuit trunks and can finally become the called subscriber, or all three at once. During these evolutions she has an absolute check on the student. She knows whether the student answers properly, calls the proper number, takes the right trunk, speaks well over the call circuit, meters properly on measured service lines, in short, she knows exactly how everything is done. She can "fish" for either the calling or called subscriber, she can cause a cut-off and then complain about it, in fact, she can do any of the various things which enter into the giving of constant telephone service.

Fig. 1 gives an excellent view of the front equipment of the switchboard at the Fairmont school. All exposed woodwork on the front of the switchboard is polished mahogany and the exposed woodwork at the rear of the switchboard is birch stained to match the mahogany.

Positions 1-2-3 are equipped for message register and coin collect service and have a subscribers multiple similar to that in use on the "A" and "B" switchboards in the company's Seymour office, and to the "B" switchboards in the Bayview, Fairmont and Highland offices.

Positions 4-5-6 are equipped for regular flat rate service and have ancillary answering jacks similar to the "A" boards in the Bayview, Fairmont and Highland offices.

The double row of lamp caps extending from one end of the switchboard to the other just above the keyboards,

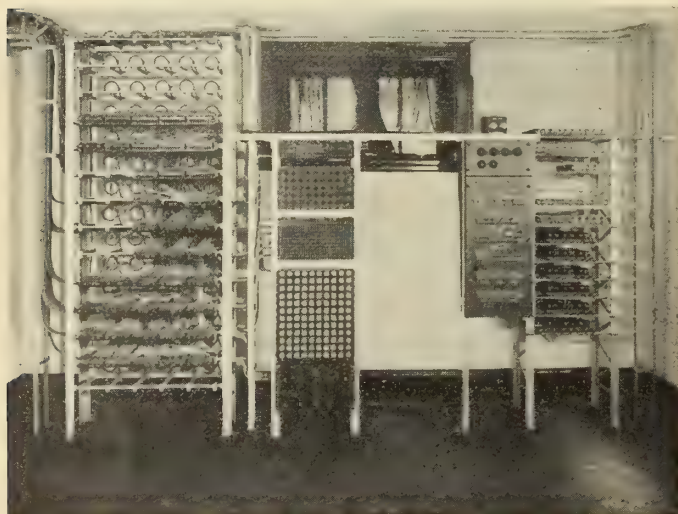


Fig. 2—View of apparatus room.

are the answering jacks where the signal from the subscribers appears.

Above the answering jacks in panels 1-2-3-7-8-9-13-14-15 is the out trunk multiple with jacks designated for the various Vancouver and two-number offices. Above the out trunk multiple and in panels 1-10 is the regular subscribers multiple of 2400 lines. Near the top of the switchboard to the right hand end are the ancillary answering jacks. These are multiplied from the regular answering jacks in the first section. The lamp caps at the top of panels 5 and 13 are the supervisors' call signals.

When an operator calls her supervisor, the supervisor's signal in the particular section lights and operates a relay which causes a bell to ring.

Fig. 2 shows a view of the apparatus room. To the left can be seen the cables coming from the switchboard and

connecting to the intermediate distributing frame. This frame is also cabled to the relay rack which is adjacent to the intermediate distributing frame and to the fuse panel of the repeating coil racks, shown to the right.

At the intermediate distributing frame, lines from the switchboard are connected to the apparatus required for the different types of line circuits. All the relays required on the

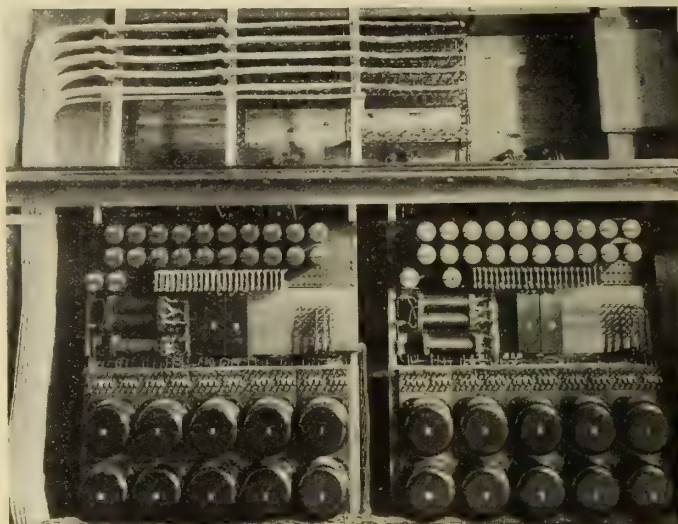


Fig. 3—Rear of Instructor's desk.

line circuits, on the switchboard, and on the instructor's desk are mounted on this relay rack.

The repeating coils used in the operators cord circuits on the switchboard and the condensers used in the trunk circuits on the instructor's desk are mounted on the repeating coil rack.

The fuse panel is made from 1¼-in. Monson Maine slate and is equipped with fuses for all the circuits used on the switchboard and instructor's desk.

Fig. 3 shows the rear equipment of the instructor's desk. To the left can be seen the cables connected to the jack strips, lamp strips and message registered relays on the instructor's desk, to the intermediate distributing frame.

The lower portion of the desk contains the operator's telephone and cord circuit equipment required on the desk.

In installing this school at Fairmont exchange the B. C. Telephone Company have gone to considerable expense. It is felt, however, that this is justified by the results. The object of the company is to give as perfect a service as possible and to do this the training school for operators is considered an absolute essential.

## Canadian National Attractions

The management of the Canadian National Exhibition have issued Bulletin No. 2, describing more fully the attractions and educative features of this year's show. As already announced, the electrical decorations will be a striking feature. Over the entrance the Union Jack and the Stars and Stripes will be entwined with the Dove of Peace floating over them and with two electric panels at the sides, one emblematic of Canada and the other of the United States. The Grand Plaza has been strung with a net-work of wires and will be canopied with twinkling electric stars. Among the other features described in this bulletin are the Boy Scouts, the Musical Ride, Art, Processes, Canada's Resources, Motor Polo, Midway and "Babylon," the wonderful Oriental spectacle in which the stage setting will consist of a view of the ancient city 700 feet in length—the largest stage in the world.



# Switchboard Back Connections

By W. A. Coates, A.M.I.E.E.

The proper design of switchboard connections is a matter which has received but little publicity. Manufacturers have experimented from time to time, but their findings have not been published. Consequently, individual designers each have their own "pet rule," the most popular being that which calls for a density of 1,000 amps. per sq inch section of copper, quite irrespective of the total current, or of the manner in which the conductor is subdivided. These same men would be horrified at the proposal to employ such a "rule" in designing any other apparatus.

The only excuse for this practice is that when using bare conductors there is no danger of damaging insulation by overheating, as in a machine winding, and from this point of view a little slackness does no harm.

It should be borne in mind, however, that heat always tends towards even distribution, and if in a system of switches and connections the latter are at the highest temperature, the heat will naturally flow to the switches. Air break switches and circuit-breakers generally have their contact faces lubricated with a smearing of vaseline, to ensure smooth working. It is very undesirable that they should get at all hot, as it would quickly cause the vaseline to thicken, thus introducing contact resistance, and setting up local heating. This is obviously a cumulative effect.

These points are generally appreciated by the larger manufacturers. The standard temperature rise both in America and Europe appears to be 30 deg. C., while British manufacturers are usually more conservative, and have adopted 20 deg. C. as a limit. On the other hand, it is not unknown for German manufacturers to work up to 40 deg. C., possibly when competition has been unusually keen.

On d.c. switchboards the factors which affect the temperature of conductors are the current passing, the cross sectional area of metal, and the effective radiating surface. The conductivity of commercial copper is so uniform that it may be neglected.

Connections should be placed on edge as far as possible, so as to get the full benefit of convection. With a bar lying flat the upper surface only is of full value, as the warm air will tend to lodge against the under-side, and prevent efficient radiation. This point is especially important in locating ammeter shunts. A difference of 15 deg. C. was observed in the case of a 4000 amp. shunt, between the temperature rise when flat and when on edge.

Where multiple conductors are employed, their total carrying capacity is largely affected by the spacing between them. It has been found experimentally that for all faces of each conductor to be effective radiators, there should be a space of at least 5/8-in. between each. This is rarely possible of attainment at the back of a switchboard carrying heavy currents, and it is therefore necessary to make a suitable allowance in rating multiple conductors.

The tables given below have been compiled from the experimental figures obtained by several of the leading makes of switchboards:—

## Maximum Permissible d.c. load in amps. Single copper straps

Size	Section	Maximum guaranteed temperature rise		
		Sq. ins.	20 deg. C	30 deg. C 40 deg. C
1" x 1/16"	.0625	130	160	185
1" x 1/8"	.125	185	230	260
1" x 1/4"	.25	265	325	375
1½" x 1/8"	.1875	275	340	390
1½" x 1/4"	.375	390	480	550
2" x 1/8"	.25	360	445	510
2" x 1/4"	.50	515	630	730

3"	x 1/8"	.375	490	600	690
3"	x 1/4"	.75	690	850	975
4"	x 1/8"	.5	610	750	860
4"	x 1/4"	1.0	870	1060	1230
6"	x 1/8"	.75	940	1150	1320
6"	x 1/4"	1.50	1330	1630	1880

It will be seen that taking the 30 deg. C. rise as standard, and for a given current, the conservative English rating of 20 deg. C. means the use of 23 per cent. more copper, while with the cheaper German construction working to 40 deg. C. there will be 13 per cent. less copper used.

The great advantage of using thin straps is also apparent. The radiating surface of a 1/8" strap is practically the same as that of a 1/4" strap, and although the resistance is of course double, the carrying capacity is only decreased 30 per cent. In the next table, therefore, only 1/8" straps will be taken into account.

## Maximum permissible d.c. load in amps. Copper straps in multiple

### Guaranteed temperature rise not exceeding 30 deg. C.

No. of straps	Size each strap.	Total section sq. ins.	1/8"	Straps spaced apart	
				1/4"	3/8"
2	2" x 1/8"	.5	760	785	860
	3" x 1/8"	.75	1000	1030	1140
	4" x 1/8"	1.0	1270	1320	1450
	6" x 1/8"	1.5	1950	2030	2220
3	2" x 1/8"	.75	880	1070	1250
	3" x 1/8"	1.125	1200	1440	1680
	4" x 1/8"	1.5	1500	1800	2100
	6" x 1/8"	2.25	2320	2770	3230
4	3" x 1/8"	1.5	1320	1700	1970
	4" x 1/8"	2.0	1650	2120	2460
	6" x 1/8"	3.0	2530	3260	3760
5	3" x 1/8"	1.875	1560	2060	2430
	4" x 1/8"	2.5	1950	2580	3040
	6" x 1/8"	3.75	3000	3960	4650
6	3" x 1/8"	2.25	1800	2430	2880
	4" x 1/8"	3.0	2250	3040	3600
	6" x 1/8"	4.5	3450	4650	5500
7	3" x 1/8"	2.625	2040	2800	3330
	4" x 1/8"	3.5	2550	3500	4170
	6" x 1/8"	5.25	3900	5360	6400
8	3" x 1/8"	3.0	2280	3160	3780
	4" x 1/8"	4.0	2850	3950	4730
	6" x 1/8"	6.0	4370	6050	7250
9	3" x 1/8"	3.375	2520	3530	4250
	4" x 1/8"	4.5	3150	4420	5300
	6" x 1/8"	6.75	4830	6750	8150
10	3" x 1/8"	3.75	2760	3900	4700
	4" x 1/8"	5.0	3450	4870	5870
	6" x 1/8"	7.5	5300	7480	9020
11	4" x 1/8"	5.5	3750	5320	6450
	6" x 1/8"	8.25	5750	8170	9900
12	4" x 1/8"	6.0	4050	5760	7020
	6" x 1/8"	9.0	6200	8860	10770

On most switchboards, flat strap is used as being handier and cheaper for connecting on to switch studs, etc. The switch studs themselves, however, are almost invariably of round rod, and occasionally rod is also found more convenient for connections.

The actual method of making connections is a question which has already been treated in a very interesting manner in a paper by Mr. F. W. Harris in the Electrical Journal. In this it was shown how the contact resistance varies inversely as pressure between faces, up to a very high limit. In view of this fact, it would hardly seem necessary to insist on the desirability of using clamp connections on all save the smallest conductors. With bolted connections, good contact and even distribution of pressure is difficult to obtain.

Even on the best fitted boards, the contacts will be



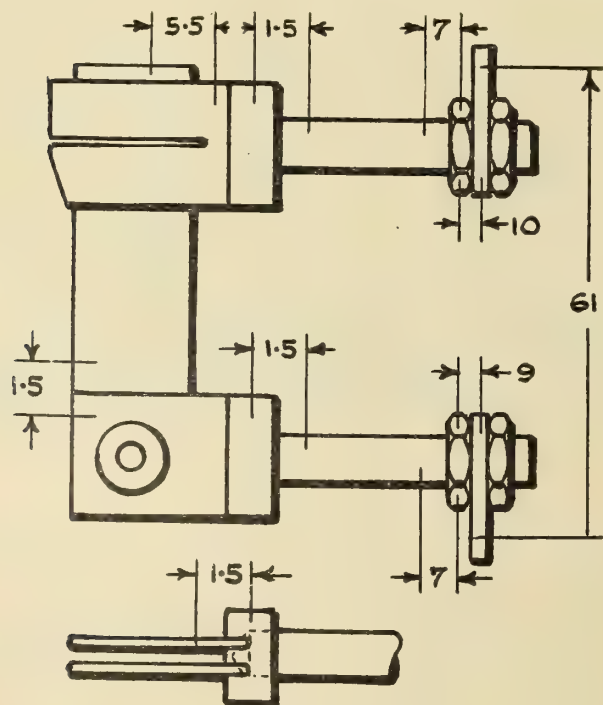
found to show appreciable resistance, and all efforts should be directed to cutting out unnecessary joints. As illustrating this point, the following case may be cited:—

A test was made to ascertain the drops across various parts of a standard 700. amp. knife switch with full load passing. The figures obtained are shown on the accompanying illustration. The actual current path, from terminal to terminal was about 27 in., and the minimum copper section .785 sq. ins. The drop across a straight piece of copper of the same length and section would only be 16.75 milli-volts, as against 61 milli-volts on the switch. This speaks for itself in emphasizing the attention which should be paid in designing, so as to reduce as far as possible the number of joints, be they sweated, screwed or clamped.

Maximum permissible d.c. load in amps. Round Copper Rod

Dia. ins.	Section sq. ins.	Maximum guaranteed temperature rise		
		20 deg. C	30 deg. C	40 deg. C
3/16"	.0276	58	70	80
5/16"	.0767	124	150	175
3/8"	.1104	164	200	230
1/2"	.196	250	305	350
5/8"	.307	350	425	490
3/4"	.442	462	565	650
1"	.785	712	870	1000
1 1/8"	.994	850	1040	1200
1 3/8"	1.485	1146	1400	1600
1 5/8"	2.074	1475	1800	2080
1 7/8"	2.76	1825	2220	2580
2"	3.14	2010	2460	2840
2 1/4"	3.97	2400	2830	3400
2 1/2"	4.90	2800	3400	3950

It will have been noticed that all the figures tabulated above have reference to d.c. only. To make a similar tabulation for a.c. working would be virutally impossible, ow-



Showing drops across various parts of knife switch.

ing to the effect of mutual induction between conductors, and to a smaller extent, skin effect.

As an example, let us assume a 60 cycle system with conductors spaced 3-in. centres; four 3" x 1/8" bars in multiple would carry about 1000 amps.; six bars would carry

1400 amps.; 8 bars would carry 1650 amps., and 16 bars 2000 amps.,—all figures being based on a 30 deg. C. rise.

The only possible way of dealing with heavy alternat- ing currents is to follow furnace practice and interleave the conductors of each phase. Fortunately, it is only rarely necessary to switch large alternating currents, and in these cases the designer must calculate his copper sections to meet his particular lay-out.

## Safety First

The Toronto Railway Company are active supporters of the Ontario Safety League. This has been shown in the distribution of literature to their employees, together with lectures and special instructions, in addition to financial



support. They have now adopted a somewhat novel but very effective scheme for further impressing the necessity of precaution.

The "Car Stop" poles of the Toronto Railway Company are painted white for some seven or eight feet from the ground and the location of the stops further indicated by the words, printed on these white poles, "Cars Stop Here." Recognizing that this is a sign which is read by every person who boards a car, the company are placing immediately below the original words, the further words in larger letters, "Safety First." To further attract the attention of the passengers, these words are painted in red. We understand that all car stop poles in the city are to be treated in this way.

The idea is a most commendable one and will undoubtedly be productive of excellent results. The illustration here-with represents one of the signs in the down-town district of Toronto.



# Mnemonic Symbolizing of General Stores

By Wilfred G. Astle\*

The object of a symbol system in the classification of General Stores is to furnish a shorthand method of designation. The symbols should contain suggestions and aids to remembering the names of the articles, so as to make it as easy as possible for a person knowing nothing about the system to locate the material in the classification as quickly as possible, after spending a few minutes in receiving explanation or studying the primal elements of such symbolization. If the classifications are such that they contain no suggestions of the material classified, it would be dependent entirely upon the memorizing of the classification by the person using it, which would be a difficult and unnecessary task.

A good symbol system should be so constructed that it will be complete, simple, flexible, uniform, and conform to all other symbol systems used in other parts of the plant, therefore, it is best when considering the installation of such a system to map out in advance all the general classifications that will be required so as to insure a uniform system.

There are three points that should always be considered when working out a symbol system for General Stores and that is:

(1) The classification should be as far as possible an aid to memory, by representing the initial, secondary, or prominent letter of the article represented.

(2) To enable convenient location of material in the storeroom by order of symbols.

(3) The classification should be such as to enable perpetual inventories in the Controlling Accounts to be kept by the main classes of material for administrative check in quantity of materials on hand in proportion to the business and orders received or schedule for work drawn up.

The letters used to denote any particular article or division in the classification should primarily be the initial letter of the name of such article or division, so that in reading the symbol the thought first goes to the letter shown as the initial of the required word.

In cases where the initial letter has already been used for another article or division the secondary letter should be used. This secondary letter, should be the letter, which, aside from the initial letter, has the most prominent sound and consequently would be secondmost prominent in the thought of the person reading the symbol.

If the initial and secondary letters have both been used already for other items the next most prominent letters should be taken.

In cases where, owing to the repetition of initial letters on the articles to be classified, it is found impossible to use a letter which would indicate the word itself, and in such cases it is necessary to leave the interpretation to the memory.

The first letter used for all General Stores symbols is S, meaning Stores, and this letter as the initial letter of a symbol should be omitted from all other classifications so that all symbols beginning with S, will indicate that it is General Stores, or Material Purchased from Outside.

The second letter should be the initial letter of the name for the particular work or article that the material is used for, to cover Stores used exclusively for that work, as for example—

SA—Stores used for Automobile Repairs.  
SG—Stores used for Lines Underground.  
SH—Stores used for Lines Overhead.  
SS—Stores used for Sealed Services.

ST—Stores used for Transformers.

SW—Stores used for Wiring Purposes.

Such material which is carried in Stores and used for a number of purposes, apart from that which is used for certain specific work only, should be classified under V—SV meaning Stores used for various purposes.

The third letter should signify the nature of the material and should be used regardless of whether the second letter is V or one of the others, indicating the general classes of work. For example, STC would mean Castings for Transformers in Stores, and SVC would mean Castings for Various Purposes in Stores.

The third division of letters for SV (meaning Stores for Various Purposes), would be as follows:

SVA—Abrasives.

SVB—Bars.

SVC—Castings and Forgings.

SVD—

SVE—Electrical Apparatus, Fixtures and Fittings.

SVF—Fastenings (Articles which hold or are held).

SVG—Gages, Gage Glasses, and Measuring Instruments.

SVH—Lumber.

SVK—Miscellaneous Metals.

SVL—Liquids.

SVM—Lump Material.

SVN—Oil and Grease Cups, Lubricators.

SVP—Powders, Crystals, etc.

SVR—Greases, Pastes, etc.

SVS—Sheets.

SVT—Tools and Implements.

SVV—Plates.

SVW—Wire.

SVX—Shop fixtures.

SVY—Yardage.

SVZ—Miscellaneous.

The fourth letter of the classification is the general subdivision of the three letter symbol. For example, under SVA (meaning Abrasives, for Various Purposes in Stores), would be given:

SVAD—Discs and Wheels.

SVAM—Lump Abrasives.

SVAP—Powdered Abrasives.

SVAS—Sheet Abrasives.

and under SVB (meaning Bars, for Various Purposes in Stores), would be given:

SVBA—Structural Shapes.

SVBB—Brass Bars.

SVBC—Copper Bars.

SVBF—Fibre Bars.

SVBM—Machinery Steel.

SVBP—Pipe, Tubing, etc.

SVBR—Cold Rolled and Cold Drawn Steel.

SVBS—Solder.

SVBT—Tool Steel.

SVBY—Babbit Metal.

SVBZ—Miscellaneous.

The fifth letter of the symbol should be the particular kind of article in the subdivision shown by the fourth letter. For example, SVAD (meaning Abrasives, Discs and Wheels, for Various Purposes in Stores), would be given:

SVADB—Bristle Buffing Wheels.

SVADC—Carborundum Wheels.

SVADE—Emery Discs.

SVADG—Grind Stones.

SVADR—Rag Buffing Wheels, etc.

As a further example of the fourth and fifth letters we

\* Storekeeper, Toronto Electric Light Company.



will take SVB (meaning Bars, for Various Purposes in Stores), in which would be SVBB (meaning Brass Bars for Various Purposes in Stores):

SVBBF—Flat or Rectangular Brass Bars.

SVBBH—Hexagonal Brass Bars.

SVBBN—Octagonal Brass Bars.

SVBBR—Round Brass Bars.

SVBBS—Square Brass Bars.

SVBBT—Triangular Brass Bars, etc.

If a further subdivision should be necessary to fully describe an article, a sixth letter can be used. This sixth letter should indicate the different makers of the five-letter symbol, and should be if possible the initial of the manufacturer's name or trade name of the article.

Except in very rare cases where all other letters are exhausted, I, J, O, Q, and U should be omitted, for the reason that in connection with figures adjoining the symbol letters, the I, O, and Q might be mistaken for figures, and J and U might be mistaken for each other or for V.

After the last letter should be given the size of the article. In giving size, absolute uniformity should be followed as to dimensions indicated by the relative position of the figures.

When three figures are used in giving dimensions, they should be given in the order of thickness, breadth and length. When one dimension only is given, it should indicate thickness or diameter. If two figures are given, the thickness should be given first and the breadth last. In the case of cylindrical articles, the first figure should be the diameter, and the last figure the length, and with tubing the first figure will be the outside diameter, the second the gage or inside diameter and the third the length.

Whether this method of designating dimensions is used or the opposite, does not matter very much, as there are good points in favor of both, but it is most essential that some one method be adopted for general use.

Care should be taken in working out symbols to make them practical and not allow long symbols for the sake of adhering to a theoretical point of complete description. For example, under Pipe, Tubing, etc., SVBP (meaning Bars, Pipe, for Various Purposes in Stores) the affixing of the letter B making it SVBPB would indicate Brass Tubing and the affixing of the letter R making it SVBPR would indicate Iron Pipe (indexing by the R in Iron). From a straight theoretical standard of mnemonic description it would be considered proper to indicate Nickel Plated Brass Tubing by the letter N following the symbol for Brass Tubing, but, under this general division, Pipe, Tubing, etc., there are plenty of unused letters and it is far more practical to show Nickel Plated Tubing in the same division as Brass Tubing, making a five-letter symbol instead of a six. Therefore we would indicate it as SVBPN.

It is better, except in possibly very rare instances, to make the general classification by the shape of the material; for example, as shown in the subdivision of SV—all bars are given in one group no matter what the material, whether hollow bars, such as pipe and tubing, or iron bars. The reason for this is that it is most convenient to store all these articles in one section of the storeroom in racks built for bars, which makes it easier to locate the material by the symbol when all such material is stored in one place, the storage properly sectioned off according to subdivisions of the general class, than it would be under the method of keeping all brass and brass products under one general class, copper, steel, wrought iron, etc., and products of same under another general class.

Under the division of SV, in the first part of this article, the object is to include in a general class all articles of the same general shape and requirements as to storage. But, sometimes this method is not practical, in such cases the classification is made to cover all articles used for a specific purpose and the first subdivision SVA—Abrasives, is an illus-

tration of this. Under SVA are included various forms of abrasives from discs and wheels, lump and powdered material to sheets, but as these are used for the same general functions of grinding, polishing or buffing, it is most convenient to have them all together in one section of the storeroom.

Under SVC, all castings and forgings are stored in one section of the storeroom. These classes should then be subdivided according to the material something as follows:

SVCA—Aluminum Castings.

SVCB—Brass Castings.

SVCC—Copper Plated Iron Castings.

SVCF—Steel Forgings.

SVCG—Grey Iron Castings.

SVCM—Malleable Iron Castings.

SVCN—Nickel Plated Iron Castings.

SVCP—Nickel Plated Brass Castings.

SVCS—Steel Castings.

SVCZ—Bronze Castings.

Under SVE would be located for convenience for storing all electrical apparatus, fixtures and fittings, etc.

SVF—Fastenings, covers all articles which hold or are held regardless of the material used for same. This will include all bolts, nuts, screws, springs, pins, nails, studs, etc., which are naturally stored in one section.

Under SVS will be included all sheets of whatever nature, these requiring special storage racks, ordinarily being adjustable shelving or racks of varying sizes for the different material carried, but of general standard dimensions. The subdivisions of Sheets would be ordinarily as follows:

SVSA—Aluminum.

SVSB—Brass.

SVSC—Copper.

SVSF—Fibre.

SVSG—Galvanized.

SVSK—Packing.

SVSL—Lead.

SVSM—Mica.

SVSN—Tea Lead.

SVSP—Paper.

SVSR—Iron.

SVSS—Steel.

SVST—Tin.

SVSV—Vulcasbestos.

SVSZ—Zinc.

Thus it will be seen by these few instances as given above that the best method of general classification is according to the nature and shape of the material, which enables the storing, and later the locating of the material desired to the best advantage.

Valuable work in the mnemonic symbolizing of General Stores or Raw Material has been done by Mr. Frederick W. Taylor and Mr. Carl G. Barth. Their methods have served as the starting point of the system which I have endeavored to describe in this article.

### One Man Cars

Four one-man, semi-convertible, prepayment cars have recently been placed in commission in Portland, Oregon, by the Portland, Eugene & Eastern Railroad Company. These cars have metal under-frame and wooden body. The general dimensions are: length of body 21 ft.; length over all 30 ft. 7½ ins.; bolster centres 13 ft.; width over sills 7 ft. 9½ ins.; top of rail to sills 2 ft. 5¼ ins. The front platform of each car has a pair of hinged folding doors and folding steps for regular entrance and exit and an additional emergency exit with folding door and folding step is located in the rear of the car. The total seating capacity is 36, including a broad curved seat extending across the rear of the car. The body of the car contains six rattan cross seats on each side of the aisle and longitudinal seats.



# Overhead Construction Standards

## Describing a Complete Line of Fittings and Devices Covering all Classes of Over-head Line Work up to 35,000 Volts, With Wooden Poles

In presenting this report to the members of the Canadian Electrical Association, at their Twenty-third Annual Convention; the members wish to be placed on record as being opposed to Standardization in its literal interpretation. By absolutely standardizing on any one method of accomplishing a desired result the Association would block further progress in the Art, if such it may be termed, of Overhead Line Construction; as any departure from Standardized methods, even if a marked improvement or advance in the art, might lead to serious complications in the event of failure from any cause of such departure to properly do its work.

With this in mind your committee herewith present suggestions for a complete line of fittings and devices covering all classes of overhead construction up to 35,000 volts and designed for use with wooden poles.

The use of poles other than wood has not been covered; as your committee feel that, while other forms of poles offer in many cases a better solution of the problem, they are not sufficiently advanced in design to permit of offering designs which could even remotely approach being standard. Such special poles should, however, have the careful consideration of our engineers before definitely deciding to stick to the older wooden pole type of construction. It is suggested however that in considering such special types particular attention be given to a design which will permit, to a large extent, the use of fittings of same standard as used on wooden poles. If this is done the pole only becomes special and stock fittings may be provided for either type of pole with a minimum storeroom investment.

The report as submitted consists largely of working drawings, made with the idea of having member companies use this report, if it meets with their approval, as a field instruction book for the members of their construction force. By doing this much time can be saved, and many mistakes avoided, due to ignorance of new men as to exact class of construction desired. With a similar standard in use in all

shown defects and, under new design, these defects have been eliminated.

No claim is made as to the superiority of these fittings or methods over others which may be in use by member companies. They will, however, effectively and economically accomplish their purpose and your committee would urge

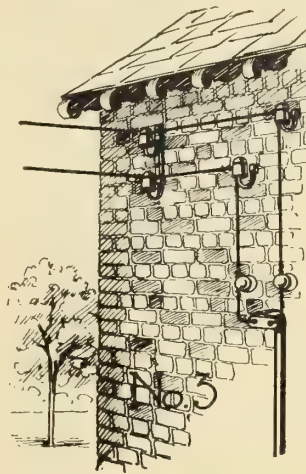


Plate 3.

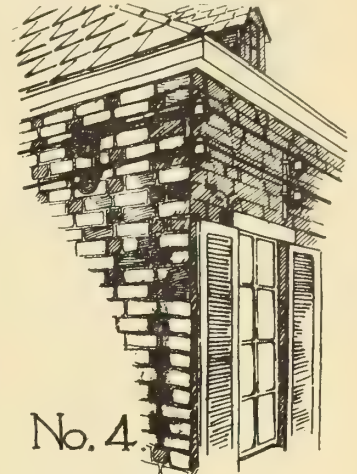


Plate 4.

upon member companies their use, if, in their judgment, they are better, or even as good, as those now used. By doing this many, if not all, of the fittings will shortly become standardized to the mutual benefit of the manufacturer, the jobber and the consumer.

This benefit would arise from lower manufacturing costs due to the demand being confined to one type of fitting, in place of, as at present many types all very similar; but differing enough to require duplication of equipment to produce, and excessive reserve stocks in order to give prompt delivery.

The jobber can afford to carry complete stocks of all fittings and handle them on a closer margin of profit, owing to possibility of a quicker turn over.

The consumer derives his benefit in being able to obtain from jobbers stock practically all fittings required; thereby effecting a considerable reduction in idle storeroom stock. He gets these fittings with minimum middleman's profit added, and with a manufacturers profit confined to that actually warranted by the production of the goods in large quantities from standard tools and equipment.

The drawings submitted cover broadly five sub-divisions of construction work.

1st.—Services.

2nd.—General distribution up to 4,000 volts.

3rd.—High tension distribution from 6,600 volts to 13,500 volts.

4th.—High tension transmission from 15,000 volts to 25,000 volts.

5th.—High tension transmission from 27,000 volts to 35,000 volts.

It should be noted that in working out these designs the same fittings are used on as many different classes of construction as possible, thereby reducing the standard stock to a minimum.

Particular attention is called to three features in their design. First: The effort that has been made to increase the useful life of our construction. All poles are treated at

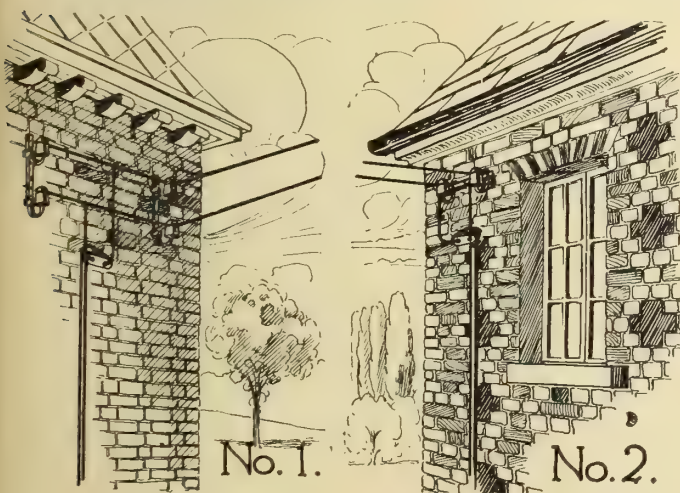


Plate 1.

Plate 2.

sections, men coming into a new section will already know construction details.

Many of the fittings and methods illustrated are now standard with practically all member companies. All of them have either been in actual use for some years by one of our larger systems; or are re-designs of fittings that have



ground line and other exposed parts with a preservative which has been proven to more than double the life of a pole. For a similar reason all wood arms are treated in order to get a life for them equal to that of the pole. Finally all exposed iron hardware is hot galvanized in order that its life may at least equal that of the other parts of the construction, and probably greatly exceed it. Galvanizing adds but

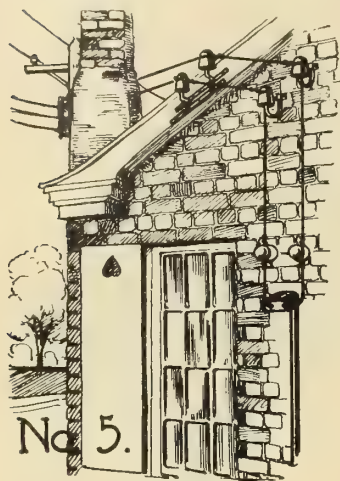


Plate 5.

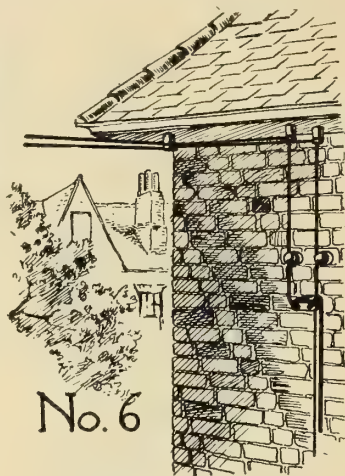


Plate 6.

about 20 per cent. to the cost of the hardware, which in itself is generally a small proportion of total cost of the line, generally not over 10 per cent. at most. To change hardware before the balance of line requires changing costs at least double what it did to first install it; and means interruption to our service while change is being made.

Second: In the design of pole framing the method of bracing has been considered very carefully from a mechanical standpoint. Under old methods we persistently violated one of the simplest mechanical rules in using a flat member to resist a large compression load. This has been responsible for most of pole framing failures in the past. A flat brace may resist normal strains for years and still be so close to the buckling point that a slight added load, such as sleet, will result in failure of an entire line. If a brace buckles to the slightest extent we convert our arm into a lever with the through bolt as the fulcrum and the opposite brace as the fixed anchorage, under tension. The natural result is the breaking of the arm opposite the gain.

In the suggested designs of framing no brace is allowed

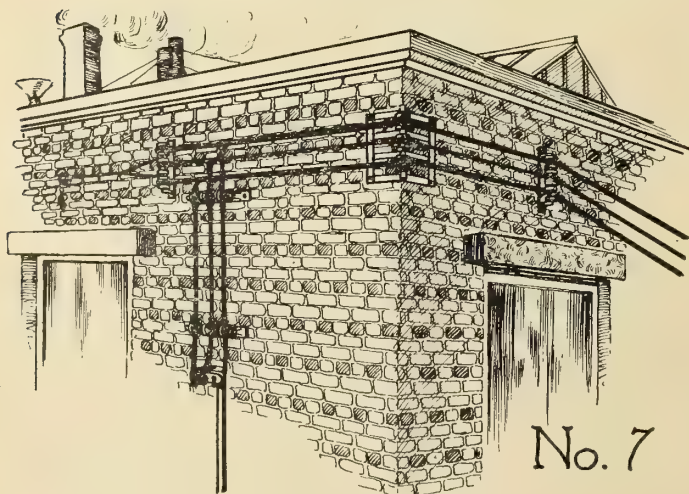


Plate 7.

under compression for use on any arm longer than 4-pin standard, or No. 2, 5 ft. 7 ins. For all arms above this size the flat brace is either under tension; or it is done away with and an angle iron brace substituted.

Third: The use of pine with wood shanks has been entirely abandoned. Metal pins make this feature of our construction as strong as the other component parts, in place of the weakest. Having a smaller pin hole in the arm also adds at least 30 per cent to the strength of the arm, and in addition, slightly decreases its manufacturing cost.

The metal pins suggested for use are either of the form having a wooden thimble, or of the spring thread type; thereby doing away with any possibility of insulator breakage due to difference in expansion, as is the case with solid metal pins.

Aside from these radical changes in suggested design or application the drawings will largely speak for themselves. Your committee have therefore confined the balance of the written report to brief descriptions of these drawings, as follows:—

Plates 1 to 8 inclusive show various types of service installations, using all metal service brackets. These brackets of various types and sizes being detailed more fully on Plates 9 and 10.

For attaching to brick and masonry walls, use is made of small expansion bolts. These are expanded in holes drilled by a hammer drill which may be of two types. First, that having a removable steel point on a chuck and rod, upon which a "dumb bell" hammer head is arranged to slide; and, second, a rotating hammer drill about the size of an

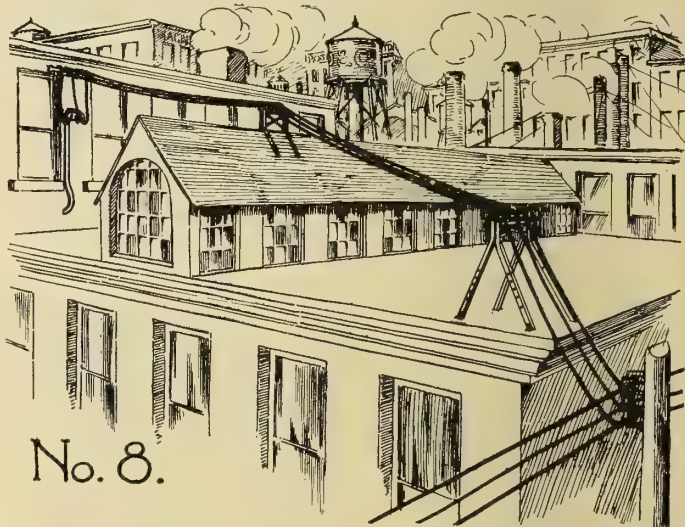


Plate 8.

ordinary breast drill. This strikes from 500 to 600 blows per minute on a steel drill point; allowing the drilling of hard brick walls as easily as drilling a wood plank. Plate 10 shows in detail the roof fixture, the application of which is shown in Fig. 8. This fitting fills a long-felt want as, while not particularly good practice to run services over roofs, this can not always be avoided. In the past it has been common practice to knock a roof trestle together from any available material on the job; and most of them look the part. The cost of this fixture will run between five and six dollars or probably less than a really good wooden fixture can be properly constructed for.

Plate 11 shows a composite pole giving proper spacing for framing, stepping, etc., to conform to use of fittings detailed. This illustrates the use of angle braces on six-pin arm, where the strain is one of compression. Also the vertical trussed brace between six-pin arms. This brace consists of two flat members trussed in centre with a bolt and spacer, giving a very stiff form of construction at minimum cost. The clearance brace over reverse arm shows the application of same fitting to more than one purpose, this being one of the trussed braces which are regularly punched with an extra hole for this purpose.

The three forms of metal shank pin are here shown applied. Also a guard iron for use where a slight angle occurs



in line, and where failure of a pin or tie might result in allowing the wire to leave the arm. This guard iron requires but one extra hole and bolt for its attachment.

Proper spacing of steps and pole sockets are also given. These spacings being those which experience has shown to be the best to suit the average lineman. It is recommended that all poles be so stepped and socketed, especially in urban and semi-urban districts as the convenience and improved appearance of the pole amply justifies the slight additional

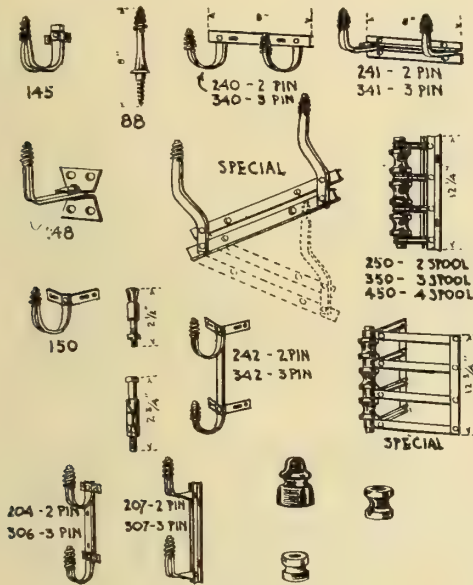


Plate 9.—Service brackets.

expense. The pole socket is particularly desirable where much climbing is necessary, as it does away with the older type of cleat-step which permits anyone, particularly children, to climb the pole. A hole bored in the pole does not fill the requirement as it wears downward and allows the climbing pins to drop below horizontal so that a firm foothold can not be obtained.

The proper method of treating butts is shown. This gives the greatest service at minimum expense. For this treatment "Avenarius Carbolinum" is suggested owing to its having proven its value. If other preservatives of proven equal value, or better, can be obtained there is no objection to their use. In applying this to a pole the first coat should be very hot and second coat cold. Gains and pole roofs should also be painted with this compound.

When it is considered that, by actual test, the life of a pole can be doubled, with indications of its being tripled, by this process at a cost not exceeding fifty cents, its value can not be disputed.

Plate 12 shows a substantial method of framing for transformer support. The drawing shows full framing for a large transformer. For medium size units the upper angle brace is omitted, and for very small units use is made of ordinary short braces. These arms are double in both cases, the rear set being fitted with ordinary short braces. The purpose of the upper double arm being to keep the primary fuse block away from transformer hangers; and that of lower arm to provide an insulated standing point for the lineman replacing a fuse.

The secondary wiring and secondary fuse block is also clearly shown here, illustrating the clear cut and neat arrangement possible with these fittings.

The primary drop wires also show the clear and safe method of construction made possible. The upper sketch shows the unusually neat method of taking off a transformer drop where the "common neutral system" is used.

The sketch to the right shows the method of bringing a high tension ground wire down a pole upon which primary lines of 2,300 to 4,000 volts are run. This gives a good de-

gree of insulation at, and for some distance from, the point where a workman must stand to work on live primary lines. This method of construction should very greatly decrease the number of fatal accidents which result from having a ground wire attached directly to a wooden pole on which live high tension work must be carried out.

Plate 13 shows details of the secondary fuse block and cleat bracket used in connection with transformer secondaries. The metal part of bracket is used either as a cleat rack or as a mounting bracket for the fuse block. The bracket is also used in other places where it is necessary to run a low tension jumper between different levels separated more than two or three feet.

The fuses used in this block are punched from thin sheet copper and therefore unaffected by the weather. The three strips in multiple permit of getting three sizes of fuse from a common stamping; so that in most systems but one type of fuse is necessary to meet all requirements of various sized transformer units.

Plate 14 shows the three arms used in connection with all voltages between 750 and 13,500. Voltages up to 600 are confined to bracket construction exclusively, where the vertical arrangement and close spacing gives a great gain in both construction, economy and general appearance of the line. At these low voltages a double thickness of weatherproof insulation can be depended upon, so that accidental actual contact of two lines rarely results in a breakdown.

The arms detailed follow closely the N. E. L. A. specification, excepting the small hole required for metal pins, and additional holes in No. 3 arm required for angle braces and high tension brace. The flat top is a distinct improvement over the old type of arm in which no firm bearing for a pin base was possible. The bevel on both top edges is stopped opposite gain space in order that either face can be used against pole.

The stock spacing block will be found a distinct improvement and saving over the old method of cutting up a

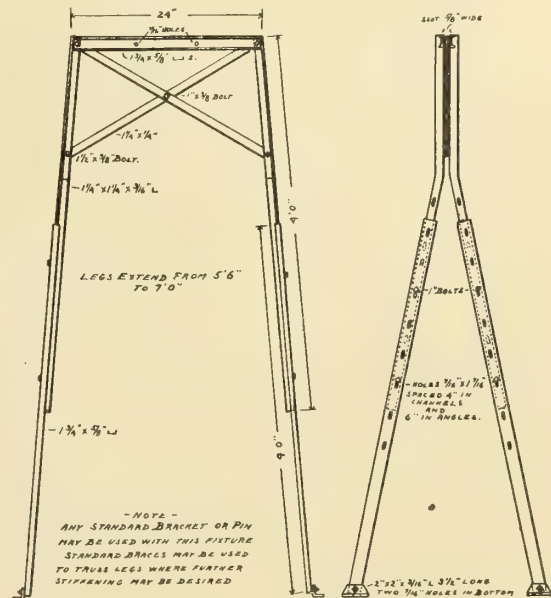


Plate 10.—Adjustable roof fixture.

more or less good arm to get a block, and then expecting a workman to bore a good true hole through end grain without a vice to hold it, and probably with a dull bit. These stock blocks will cut three average spacers with little waste.

These arms and blocks, in common with all other arms hereafter detailed are treated with two dipped coats of avenarius carbolinum. For this purpose a metal trough should be provided, so that a coke fire can be kept under it to keep carbolinum hot. The tank should be long enough



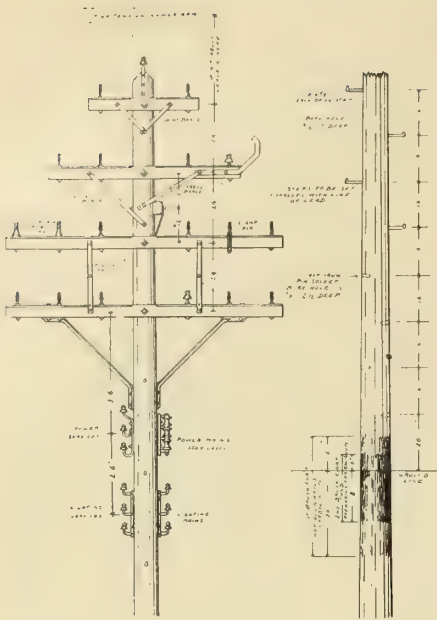


Plate 11.

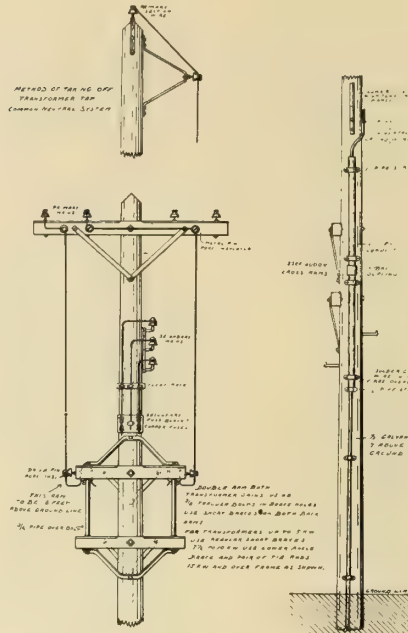


Plate 12.

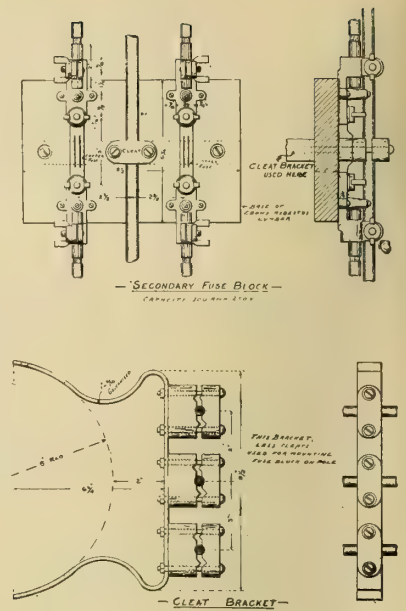


Plate 13.

to take the largest arm used, and should be provided with a slanting drainage board upon which arms can be allowed to rest for a few moments after dipping. This will save considerable compound which would otherwise be wasted.

Plate 15 shows details of pole hardware, most of which is self-explanatory.

The upper sketch shows standard brace as recommended by N. E. L. A. Next is shown the special trussed brace with its spreader tube, also the extra hole necessary to permit its use as a reverse arm brace. The short brace is used only with No. 1-2 pin arms.

The guard iron is shown in three lengths of strap, adapting it for use on any arm and for any voltage between 750 and 13,500. The ground wire bracket can be used singly for light ground wires, or in pairs for heavier wires or on angles. The upturned lip with groove prevents the ground wire becoming displaced should its fastening become loose. The outer edges of this groove or notch, should be slightly ground to a smooth radius before galvanizing, in order to avoid any possible chafing of the ground wire. For fastening the wire a lashing is made from a strand cut from the regular ground wire.

In plate 16 is shown at top a channel iron back brace, similar braces being shown later on for higher voltage construction. By the use of these braces double arming can frequently be avoided. Their use is principally where it is desired to prevent twisting of the arm. Where unusual pin strain is expected, or in making dead ends, double arms should always be used.

The remaining sketches show hardware required for transformer arm framing as previously described; also the common neutral bracket which can also be used for several other purposes. The pole top pin gives a very rigid construction and can be used for all cases where a top wire is required.

Plate 17 details the smaller class of hardware and is self-explanatory. The pole socket can be cast at any iron foundry from patterns gated in groups of four or five and requires no machining other than grinding off the gates.

Particular attention is called to the driving face on drive step. Steps made by simply bending over the round stock are very hard to drive straight and without bending. The slight saving in cost is lost many times over in labor wasted during installation.

Plate 18 schedules all machine bolts required in construction work. Particular attention should be paid to hav-

ing good clear threads so that nut can be set up by hand. A bolt cut for use without galvanizing will not give good results if galvanized. Bolts should therefore be cut, with galvanizing in mind, at the bolt works.

Plate 19 shows a full line of insulators and pins required for any voltage within the range of this report. They are all standard and easily obtainable. The high tension insulators are designed to give good service both electrically and mechanically at minimum first cost. Being attached to screw pins of a type allowing for expansion, all troubles arising from having metal within porcelain or glass are overcome.

Plate 20 shows a full line of guy wire fittings which have proven their utility from practical application. The



Plate 14.—Low and medium tension cross-arms.

porcelain insulator is much cheaper than the older type of strain and has the great advantage that its probable electrical condition is visible to the eye, which was far from the case with the older type of built-up metal and composition strains.

The guy wire shim is a simple little fitting which saves weakening the pole by having a heavy guy cut into it. Unlike other shims it carries its nails with it.

The boltless guy clamps will be found much preferable to older bolted type, being a great saver of time, temper and teeth.

The screw anchors will be found to give good service in sandy soil or loam, but cannot be used, of course in rocky











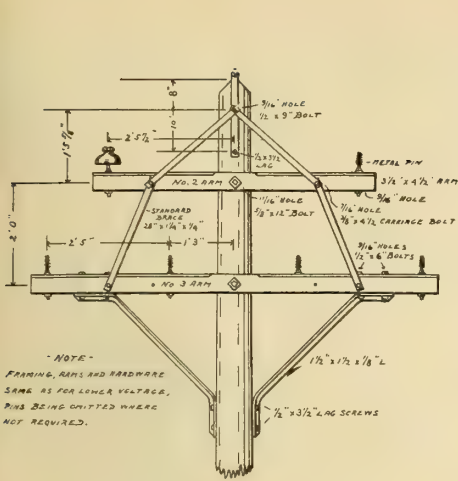


Plate 23.

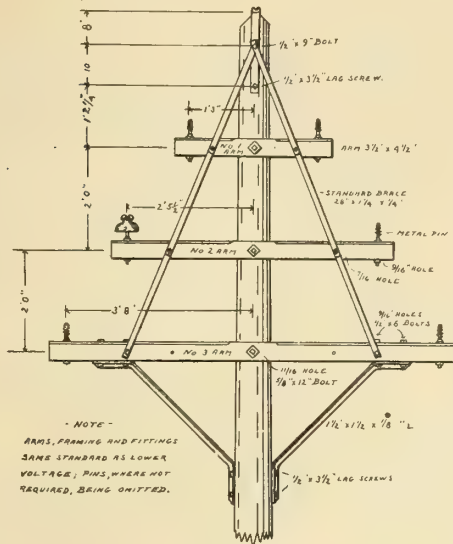


Plate 24.

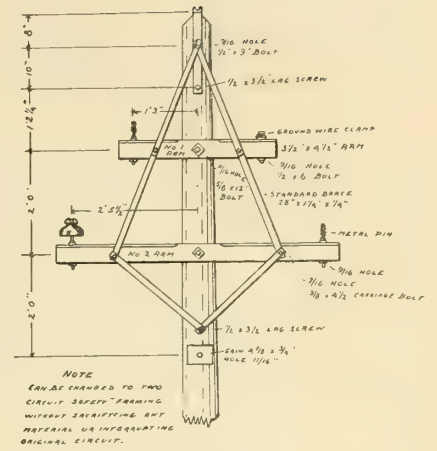


Plate 25.

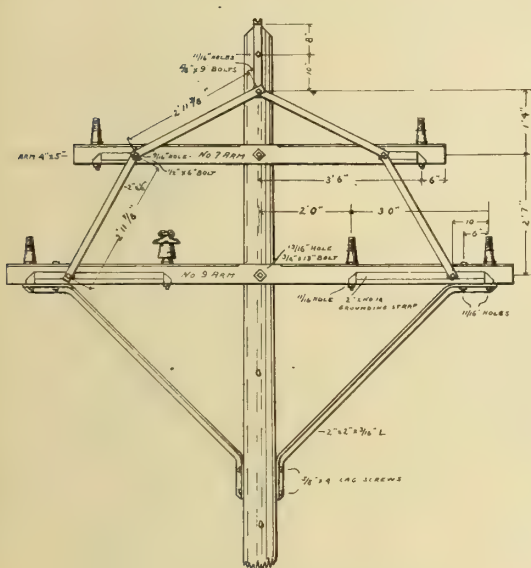


Plate 26.

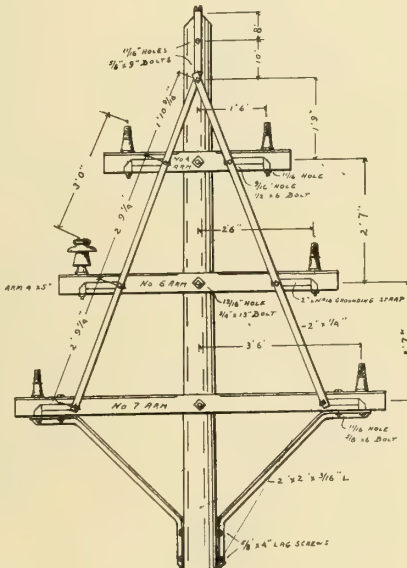


Plate 27.

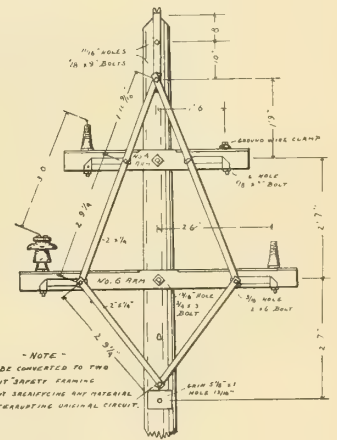


Plate 28.

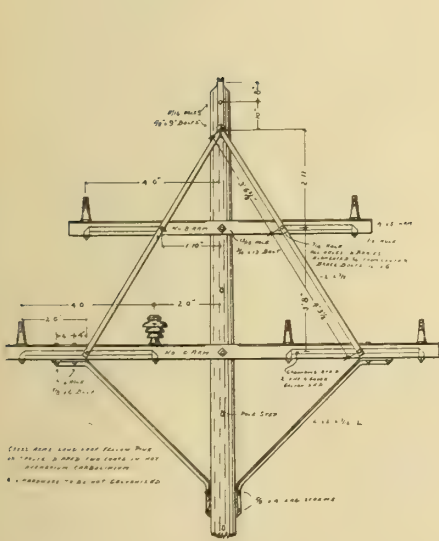


Plate 29.

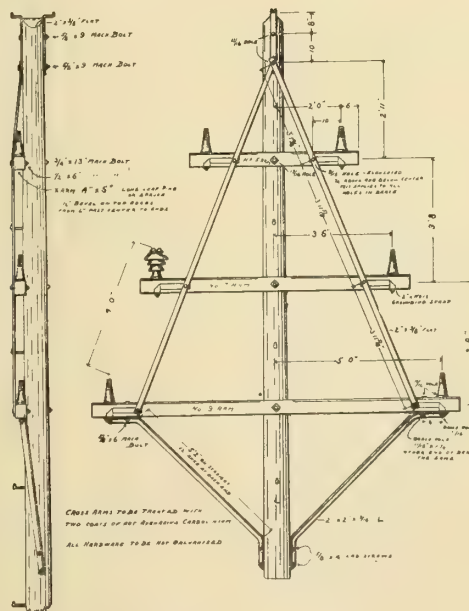


Plate 30.

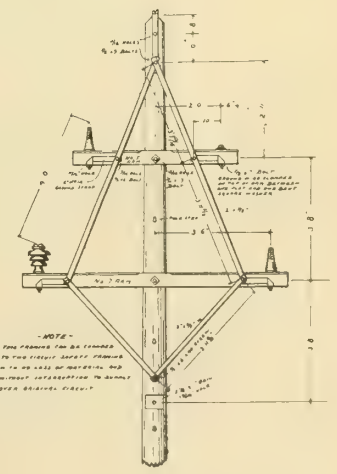


Plate 31.



ittings are omitted and flat braces are cut into two sections and lower pieces used for bottom braces.

The ground wire is clamped to end of upper arm in order to get it more nearly in the centre of the system, both from a mechanical and an electrostatic standpoint.

In the event of an extra circuit being necessary the

its one-phase wire from the end of final middle arm to opposite end of new lower arm.

This "safety" triangle has one advantage in that a wire slipping a tie due to unequal ice loading, or being set into vertical oscillation following dropping of ice in patches, can not possibly come in contact with the wire above it, due to

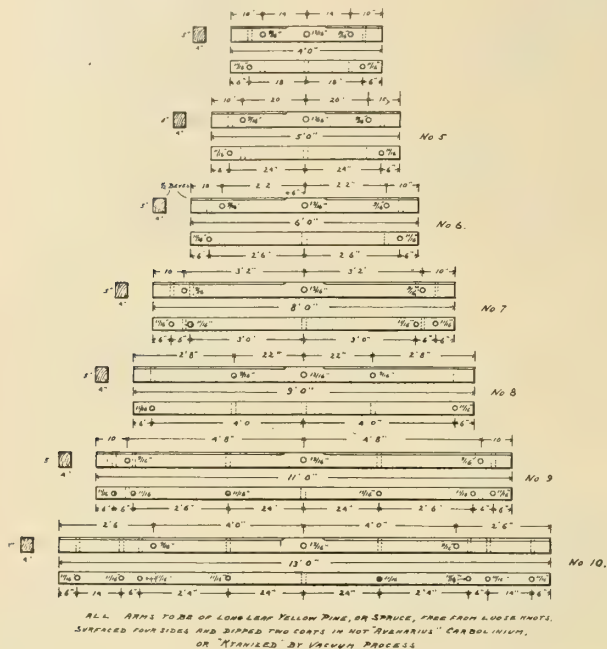


Plate 32.—High tension cross arms.

lower arm can be installed and braces previously used for arm above swung down to permanent position. The wires on new lower arm can then be strung and circuit transferred to its permanent position on this side of the pole. Ground wire then moved up to bracket at top of pole and the

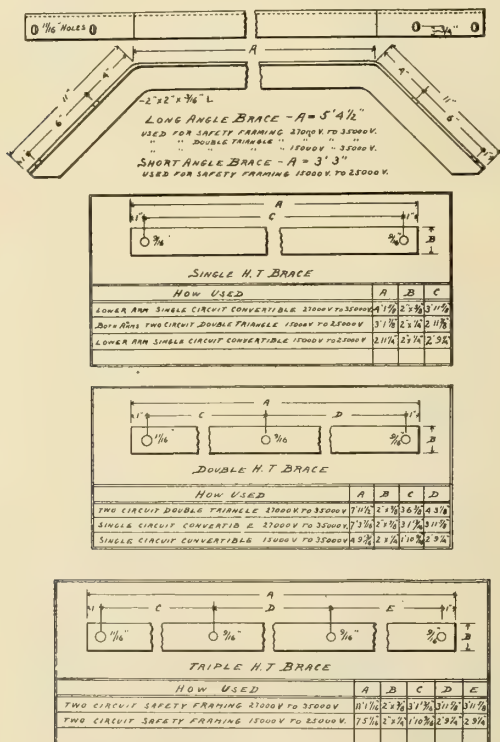
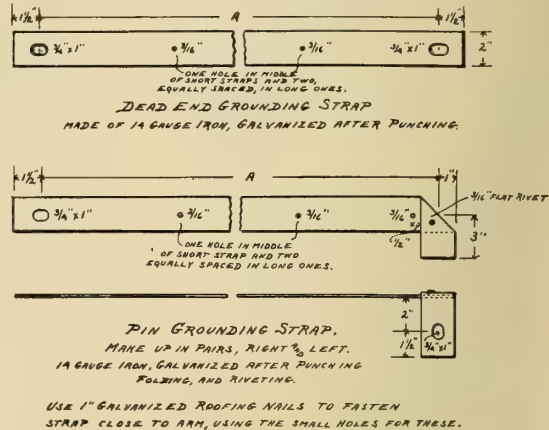


Plate 33.—Details of high tension hardware.

final wire of second circuit strung in its former position. These changes can all be carried out without sacrificing any of the original material and with but one trifling interruption to the former single circuit—that necessary to transfer



DIMENSION "A,"	WHERE USED
10 INCHES	SINGLE CIRCUIT CONVERTIBLE 27000V. TO 35000V. " " " " 15000V. " 25000V. TWO CIRCUIT SAFETY 27000V. " 35000V. " " " " 15000V. " 25000V. " " DOUBLE TRIANGLE 15000V. " 25000V.
24 INCHES	TWO CIRCUIT DOUBLE TRIANGLE 27000V. TO 35000V.
26 INCHES	TWO CIRCUIT DOUBLE TRIANGLE 27000V. TO 35000V. LOWER " 2 " " " 15000V. " 25000V.

Plate 34.—High tension grounding straps.

the offset spacing being greater than the striking distance of the voltage. This is one of the points where failures in straight vertical framing have occurred.

In spacing poles with the circuit spacing herein provided the following span lengths should not be exceeded:—

6,600 to 13,500 volts	135 feet
15,000 to 25,000 volts	150 feet
27,000 to 35,000 volts	200 feet

With these span lengths and wires pulled up to proper

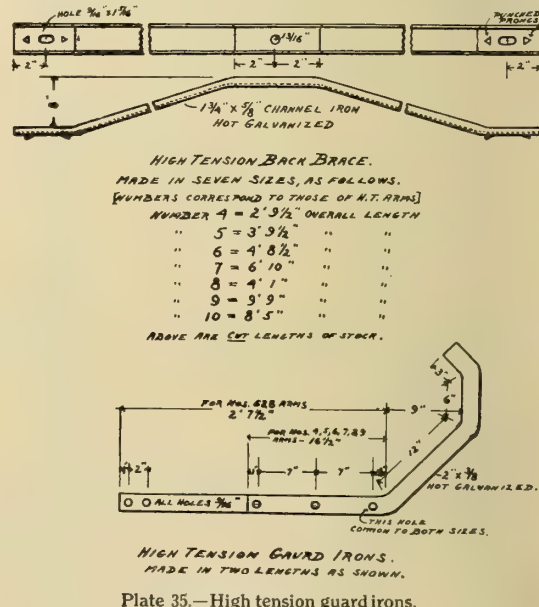


Plate 35.—High tension guard irons.

tension the lines can not swing within striking distance with temperatures up to 100 degrees.

The remaining plates, 32 to 35 inclusive, cover details of hardware for this high tension framing, and not previously shown.

(Concluded on page 63.)



# Present Status of Prime Movers

## A Very Valuable Report on the Latest Developments—Summary of Investment and Fuel Costs

By H. G. Stott, R. J. S. Pigott and W. S. Gorsuch

The Committee on Prime Movers has selected the following subdivisions of its subject, in order to cover the most important recent developments in the field of prime movers:

- 1. Reciprocating steam engine
- 2. Steam turbine
- 3. Gas engine
- 4. Oil engine
- 5. Hydraulic turbine
- 6. Finance and economics.

In order to show the present status of the art in a graphic manner, practically all of the data obtained have been plotted in curves which appear in the appropriate place in the text.

### Reciprocating Engine

The reciprocating steam engine has, during the past five years, become practically obsolete for use in modern power stations. In the large new central station this engine is not even considered; but in small isolated stations it is still used to a considerable extent, especially where heating service is also handled. In small sizes, the engine still has some advantage in economy over the small turbine, but the margin is getting continually smaller; some of the latest geared units being almost on equal terms. The non-condensing and bleeder turbines have offered a satisfactory substitute for the engine on heating service; the continuance of the engine in use is therefore chiefly due to the apparent inability of purchasers for isolated plants to realize that economy of steam is only one of the items constituting cost of power. The superior reliability, low maintenance, sustained original economy, and low attendance cost of the turbine generally overbalance the rather doubtful advantage in original economy of the small reciprocating engine.

### Steam Turbine

The steam turbine is now at the head of the list of

prime movers. The items of comparison with other prime movers are:

- (a) Capacity
- (b) Efficiency
- (c) Weight
- (d) Price.

Capacity and Efficiency.—Usually the figure quoted as the measure of efficiency is the water rate or steam consumption per kilowatt hour. Hardly any measure can be selected which is less satisfactory, since, unless the steam and vacuum conditions are stated, the water rate means nothing. Two turbines of exactly equal merits may be quoted as having very different water rates if one is operated on superheated steam with high vacuum, and the other wet steam and lower vacuum. To fix the merits of the design, a knowledge of the efficiency ratio (Rankine cycle) is necessary; and to fix the thermal efficiency, a knowledge of the steam conditions is needed—in other words, the heat drop available.

The water rate of a perfect Rankine-cycle engine is given as 3,415 divided by the available adiabatic heat drop between initial and final conditions of the steam. Table I. gives a few values for the commoner conditions in use. The efficiency ratio is equal to the Rankine-cycle water rate divided by the actual water rate of the turbine. The thermal efficiency and the water rate are both dependent upon the steam conditions, and can never be correctly compared except upon the same basis of pressure, superheat and vacuum.

The efficiency ratio is a measure of the goodness of the design, influenced somewhat by steam and vacuum conditions. The efficiency ratios of modern turbines differ much less from each other than the variation of water rates would lead one to suppose.

The efficiency ratio increases (a) with size, (b) with superheat, (c) with reduction of vacuum down to about 26 ins., (d) with reduction of pressure. Speed also effects efficiency ratio, either to increase or decrease it, depending upon the design and conditions. Thermal efficiency increases (e)

TABLE I.

HEAT DROP AND WATER RATES FOR 100 PER CENT RANKINE-CYCLE EFFICIENCY.

Press.	Dry steam.						100 deg. superheat.						150 deg. superheat.					
	28 in.		28.5 in.		29 in.		28 in.		28.5 in.		29 in.		28 in.		28.5 in.		29 in.	
	H.D.	W.R.	H.D.	W.R.	H.D.	W.R.	H.D.	W.R.	H.D.	W.R.	H.D.	W.R.	H.D.	W.R.	H.D.	W.R.	H.D.	W.R.
lb. per sq. in.	B.t.u. per lb.	lb. per kw.	B.t.u. per lb.	lb. per kw.	B.t.u. per lb.	lb. per kw.	B.t.u. per lb.	lb. per kw.	B.t.u. per lb.	lb. per kw.	B.t.u. per lb.	lb. per kw.	B.t.u. per lb.	lb. per kw.	B.t.u. per lb.	lb. per kw.	B.t.u. per lb.	lb. per kw.
165	324	10.52	338	10.09	355	9.61	345	9.89	360	9.47	378	9.03	353	9.66	368	9.27	387	8.82
190	331	10.30	348	9.80	364	9.37	356	9.58	369	9.25	387	8.82	365	9.35	379	9.00	398	8.57
215	341	10.00	354	9.63	371	9.19	363	9.40	376	9.08	394	8.66	373	9.14	387	8.81	406	8.41
240	347	9.83	361	9.45	378	9.02	371	9.19	385	8.86	403	8.46	380	8.98	396	8.61	413	8.24
kg. per sq. cm.	cal. per kg.	kg. per kw.	cal. per kg.	kg. per kw.	cal. per kg.	kg. per kw.	cal. per kg.	kg. per kw.	cal. per kg.	kg. per kw.	cal. per kg.	kg. per kw.	cal. per kg.	kg. per kw.	cal. per kg.	kg. per kw.	cal. per kg.	kg. per kw.
11.59	180.0	4.78	187.8	4.58	197.1	4.36	191.5	4.48	199.9	4.30	209.8	4.09	196.0	4.38	204.5	4.21	214.8	4.00
13.36	183.8	4.67	193.1	4.45	202.1	4.25	197.8	4.34	204.8	4.19	214.5	4.01	202.5	4.24	210.5	4.08	221.0	3.89
15.10	189.2	4.53	196.3	4.38	206.0	4.17	201.5	4.27	208.8	4.12	218.5	3.93	207.2	4.14	215.0	4.00	225.2	3.82
16.87	193.7	4.43	200.5	4.29	209.8	4.10	206.0	4.17	213.5	4.03	224.0	3.84	211.6	4.07	219.8	3.91	229.5	3.75



with pressure, (f) with superheat, (g) with vacuum. It is evident that some of these conditions at least are incompatible with each other, and that the turbine having the best water rate may not have the highest efficiency ratio.

Fig. 1 shows water rates which may be obtained for various sizes of machines. For the standard conditions of 175 lbs. gage, 100 deg., superheat, 28½ ins. vacuum, the average value is that which will ordinarily be obtained for standard designs; but better or poorer rates may be obtained under special conditions, either of design for high efficiency, which increases cost, or of cheap construction, which usually means poor water rate.

Fig. 2 shows the Rankine-cycle efficiency ratios under the same conditions. For the same sizes of machine, 25-cycle generators will have the same water rate and efficiency ratios, as the variation in speed can be readily cared for without sacrifice of efficiency. The corrections for other steam and vacuum conditions must be applied to get the proper water rates—these differing somewhat for different types. The usual superheat correction is one per cent improvement in water rate for each 10 deg. superheat between saturation and 100 deg.; one per cent for each 12½ deg. superheat between 100 and 200 deg. superheat. The vacuum correction varies considerably with different machines, and

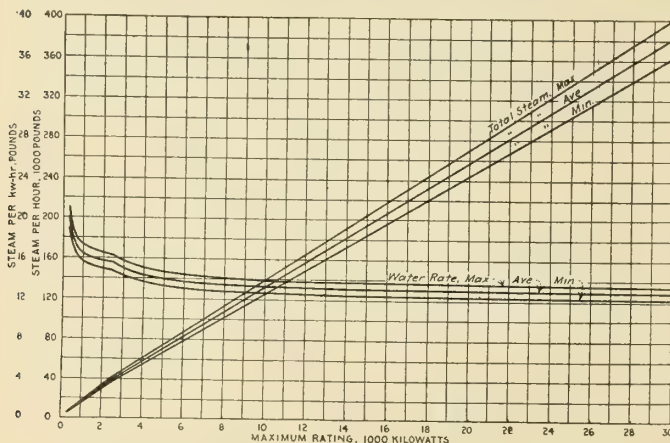


Fig. 1.

amounts to about 5 per cent improvement between 27 and 28 ins.; 6 per cent between 28 and 29 ins. A better method is to use the total heat drop available in each case as a ratio applied to the water rate. An important feature influencing cost is the matching of generator and turbine. In many cases the turbine has its best water rate at the maximum 24-hour rating of the generator. For many purposes this is undesirable. The best water rate should occur at from 75 to 85 per cent of the maximum 24-hour rating of the generator; in other words, the turbine should be smaller than the generator.

The overload devices (extra nozzles in the case of impulse turbines and by-passing in the reaction turbines) can be readily designed to take care of the loads up to 50 per cent in excess of the best water rate load in the turbine. The best water rate reached by the turbine occurs just before these overload devices operate; and it is for the steam flow at these loads that the turbine proportions are designed. When the effect of auxiliary steam consumption on the steam demand of the engine room is considered, it is evident that the under-sizing of the turbine to a small degree is desirable.

**Weight.**—The weight increases with the increase of vacuum, decrease of speed, decrease of initial pressure, and increase of efficiency ratio. The increase of vacuum obviously affects the weight by increasing the size of the exhaust end and the blading. Decrease of speed increases the weight, as it enlarges the dimensions in every direction for a given capacity, and sometimes increases the number of

stages for a given efficiency. Increase of efficiency ratio usually implies sharper blade angles, more stages, and larger blading, which obviously increases the weight. Fig. 3 gives the total weight and weight per kilowatt under the standard conditions previously stated.

**Cost.**—The turbine design is usually a compromise between cost of manufacture and efficiency. The cost is influenced by steam conditions, speed, and by type, to some

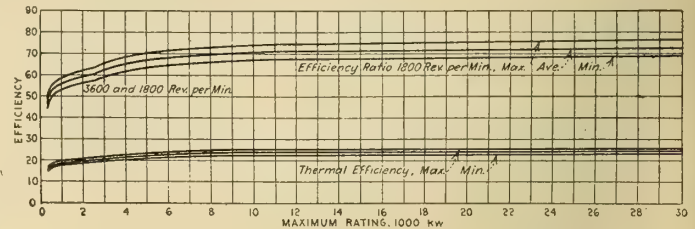


Fig. 2.

extent. Increased thermal efficiency means increased cost, as it means increased blade dimensions, stages, and exhaust openings for higher vacuum and in some cases altered construction to suit higher superheats.

Fig. 4 is cost per kilowatt and total cost for machines built to the standard conditions previously given, delivered and erected within 600 miles of factory. 25-cycle machines will cost from 15 per cent more, in smaller sizes, to 10 per cent more in the larger sizes. Cost per lb. (Fig. 5) remains about constant for any given capacity, so that this increase in cost for 25-cycle machines is readily explained, as the reduction in speed from 1,800 to 1,500 and from 3,600 to 3,000 revolutions raises the weight approximately in inverse proportion to the decrease in speed.

The three items which influence the purchasing of a turbine are price, water rate and time of delivery. The time of delivery cannot be much reduced beyond a certain point. There is, therefore, a very strong tendency to cut the price or the water rate in order to get the business where competition is very keen. As only about one turbine in every 50 sold is ever tested, the opportunity to manipulate the water rate of the turbine downward has often proved a stumbling block to good engineering. The cost to manufacture any of the standard makes is not very different. The prices ordinarily will therefore be about the same. The tendency to cut the water rate below what can actually be obtained can therefore only be checked by the engineer's watchfulness. Comparison with the Rankine efficiency ratio for any size machine is one of the safest means of detecting

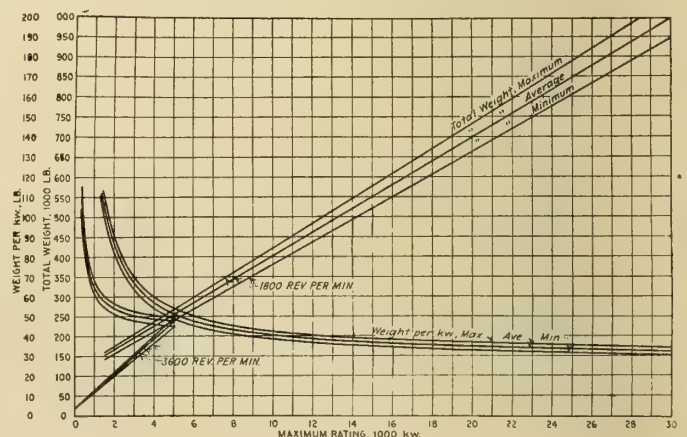


Fig. 3.

spurious water rates, since they will give impossible efficiency ratios.

### Gas Engines

The fuel supply for the various classes of this type of prime mover is obtained either by the conversion of coal,



coke, lignite, peat, wood, oil or other kindred fuels into a gaseous product in a producer; or from natural resources, or the recovery of waste or by-product gases from blast furnaces and coke ovens. The utilization of natural gas and blast furnace gas has enabled a wide application of the gas engine, amounting to over 75 per cent of the total gas power machinery installed in the United States, the natural gas being in the lead as to aggregate capacity.

The development of large gas engines is largely due to the ideal conditions existing in steel industries where large

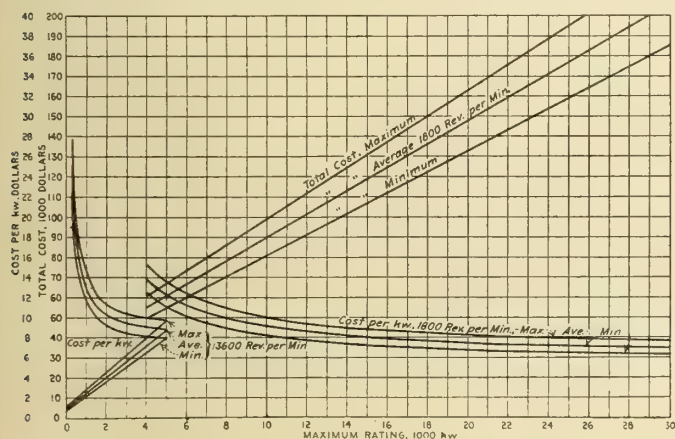


Fig. 4.

quantities of blast furnace gas are available, requiring only cleaning to make a perfect fuel for this type of prime mover. Blast-furnace-gas power plants have been especially striking owing to the magnitude of the engine, which has now reached a capacity of 6,000 brake horse-power for a single unit of the twin tandem type.

The main improvements in gas engines have been in the reinforcement of cylinder castings, simplicity of the cylinder, piston and rod construction, more efficient packing, adoption of the throttling governors, etc.

The rapid introduction of the gas-producer in the manufacture of gas from cheap grades of coal has given special impetus to the producer gas engine. Many of the low grades of fuel which are not fit for use under the steam boiler have been used with reasonable success in the producer.

There is now a growing demand for gas engines to operate with coke oven gas, and probably interesting developments may be expected along this line within the next few years.

With the universal tendency toward high-speed rotative machinery, engineers engaged in the development of internal combustion engines have recently shown renewed activity in substituting rotary for reciprocating motion. While much valuable information has been obtained, yet the practical

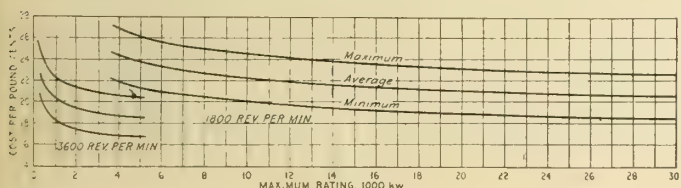


Fig. 5.

difficulties have not been surmounted and the gas turbine has not reached a commercial stage. However, if the gas turbine does come, it will probably revolutionize power production in large steel centres and wherever natural fuel oils abound in this country.

Capacity.—There are two general types of gas engines known as the two-cycle and four-cycle, or two-stroke and four-stroke, built with single or double-acting cylinders, either vertical or horizontal, the usual form in sizes above

200 brake horse-power consisting of two double-acting cylinders set tandem. By combining two such units we have the twin tandem type that is built in sizes as large as 6,000 brake horse-power. The four-cycle engine is the type that is almost always used in units of any appreciable size, and especially the double-acting four-cycle type with two cylinders arranged in tandem, which was brought to a commercial state about eleven years ago.

Steam turbine and engine ratings are usually such that they are worked under their most economical load at the rating of the electrical generator. With gas engines, on the other hand, the efficiency increases with the load beyond the capacity of the engine (see efficiency curve, Fig. 6), and for this reason the rating of the engine is generally made as nearly as possible to its maximum capacity, allowing from 10 to 20 per cent for overload.

The gas engine does not possess inherent capacity for overloads in the same sense in which the steam turbine and engine do, hence whatever overload it has, is allowed by the manufacturer. The maximum capacity of a gas engine is evidently reached when the cylinder has taken a full charge of mixture of the highest heat value and density, that is, containing the maximum B.t.u.'s per cu. ft. This being the case, it is evident that gas engines must accommodate themselves to variations in the quality of the gas. Assuming for illustration, that a 10 per cent overload is sufficient, an engine of 550 horse-power maximum capacity would then be rated at 500 horse-power.

The gas engine being fairly limited as to the power which may be produced in a single unit, there has developed on the part of some manufacturers a disposition to increase

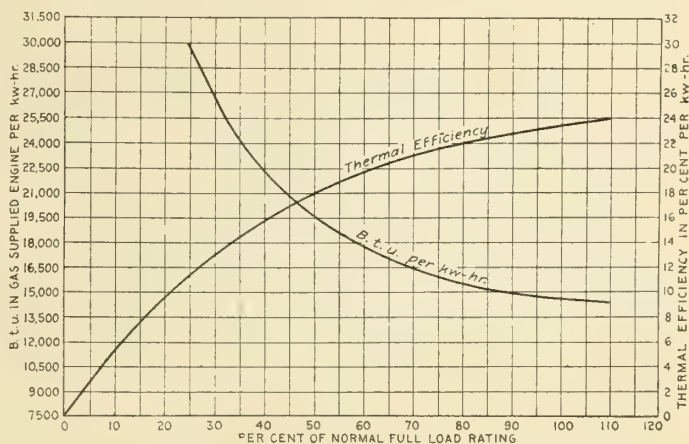


Fig. 6.

speeds. While high speeds have been used in steam turbine and engine practise, it should not be taken as a criterion in gas engine work, as the heavy masses involved in the reciprocating parts of the gas engine may become destructive and the result may be higher maintenance cost.

Efficiency.—One of the characteristics of the gas engine which other heat engines do not possess is that the thermal efficiency remains fairly uniform over all ranges of sizes.

Fig. 6 shows representative curves of thermal efficiency and rate of heat consumption per kilowatt generated for different percentages of normal full-load rating of large four-cycle producer and natural-gas engines, no allowance being made for auxiliaries.

Many figures have been given of the thermal efficiency of the gas engine which vary materially, but we believe that the curve above referred to gives conditions generally met within large gas engines, namely, 25.2 per cent. on the basis of brake horse-power, or 23.8 per cent on the basis of kilowatt-hours generated at full load rating. All curves of the gas and oil engines have been referred to the basis of kilo-



watt-hours generated so as to be comparable with the steam turbine and engine.

The range of fuel consumption as guaranteed by American manufacturers for their engines at full load rating with different fuels varies from 9,500 to 13,500 B.t.u. per brake h.p.-hr. (2,394 to 3,402 large calories) for producer gas, and 8,500 to 15,000 B.t.u. per brake h.p.-hr. (2,142 to 3,780 large calories) for natural gas, or reducing to basis of kw.h., 13,500 to 19,200 B.t.u. per kw.h. (3,402 to 4,838 large calories) for producer gas, and 12,200 to 21,400 B.t.u. per kw.h. (3,074 to 5,393 large calories) for natural gas. Blast furnace gas runs in the neighborhood of 10,500 B.t.u. per brake h.p.-hr.

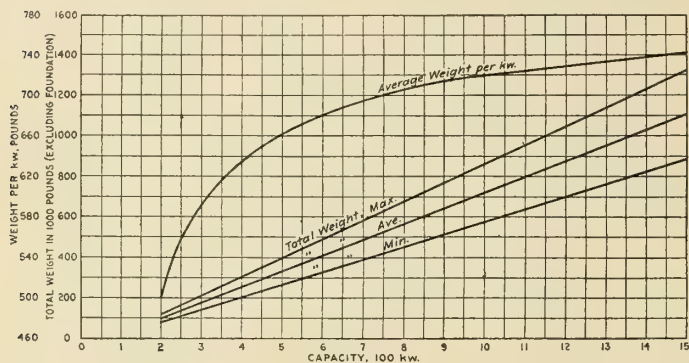


Fig. 7.

(2,648 large calories), or 15,000 B.t.u. per kw.h. (3,780 large calories) generated.

**Weight.**—The operation of the gas engine involves high temperatures and pressures suddenly applied to the working parts, consequently this class of prime mover is inherently massive.

The range in weights of the various sizes of horizontal type producer-gas and natural-gas, four-cycle single and double-acting tandem and twin-tandem gas engines, as manufactured by the largest gas engine companies in this country, are shown in Fig. 7.

These curves are drawn to include all capacities from 200 to 2,000 kw., and show that there is a variation of 20 per cent from the average weight. Considering the curve of average weight per kilowatt, one thing is basic, namely, that the big unit weighs more per kilowatt than the small unit. The reason is that as you go up in size and lengthen out the stroke the weight runs up per unit capacity. The weight is governed by many considerations, such as rotative speed, the mean effective pressure on which the builder figures his rating, the nearest size the builder has to fit a given generator, the question of single or double crank, etc.

**Cost.**—On account of the heavy parts made necessary by high temperatures and pressures, the gas engine is considerably more expensive to build than steam turbines or steam engines.

In some types of gas engines there is not very much difference between the cost per unit capacity in large and small sizes, whereas with other companies it varies considerably.

Fig. 8 shows the limits of total cost, average cost per kilowatt capacity, and average cost per pound, of the type and size of engine and generator as described in Fig. 7. The price is for engine and generator complete and installed exclusive of foundations within 600 miles of factory. It will be seen that the price varies 18 per cent from the average for the different types.

The cost of the gas engine is influenced by the same conditions that govern the weight, as explained above. The different combinations of stroke and synchronous speed result in varying piston speeds, and for a given power the price will be higher the lower the speed. Many attempts have been made to lower the cost of the gas engine by decreasing the weight without impairing its reliability, and to increase its capacity by increasing the pressure of the charge

and simultaneous scavenging of the exhaust gases, but all without definite results.

### Oil Engines

Oil engines have progressed rather slowly in this country, while in Europe the development has been more marked, especially since the expiration of the basic Diesel patents in 1912.

The Diesel engine is essentially a vertical type, but the last two years have witnessed a remarkable development of the horizontal type. While tests show that the fuel consumption is slightly higher than with the vertical type, nevertheless on account of the greater simplicity and better accessibility and lower cost, many manufacturers have launched out to build them.

There are approximately 300 installations of medium and heavy-duty oil engines, aggregating over 75,000 h.p., in operation in the United States.

On account of the very high cost of natural oils in countries that do not have an oil production of their own, the use of tar oil with a small addition of ignition oil in the Diesel engine is rapidly finding favor. Some oil engines operate satisfactorily on any fuel and especially the crude oils produced in this country, while others are limited to certain qualities. The recognition that coal is too valuable a fuel to be wasted in our present-day furnaces, is spreading, and much interest is being taken in the by-product coke oven and by-product gas producer plants, in hope that the production of tar oil, an artificial product, will aid to check the advance in price of natural liquid fuels. In this country the condition is different on account of the supply of rich natural oils, such as the light grades of crude oil produced in the eastern fields, as well as the heaviest grades produced by the California, Texas, Oklahoma and Mexican fields, which are largely asphalt base.

**Capacity.**—Similar to the gas engine, the oil engine does not possess an inherent overload capacity in the same sense that the steam turbine does, hence, whatever overload is required must be provided by the manufacturer.

The oil engine is restricted in size for the same reasons given in the case of gas engines. The largest Diesel engine operating in this country is a 450 brake horse-power double-unit vertical four-cycle three-cylinder type, whereas in Europe they have been built as large as 2,500 brake horse-power. There has recently been built in Germany a 2,000 brake horse-power horizontal double-acting, four-cycle,

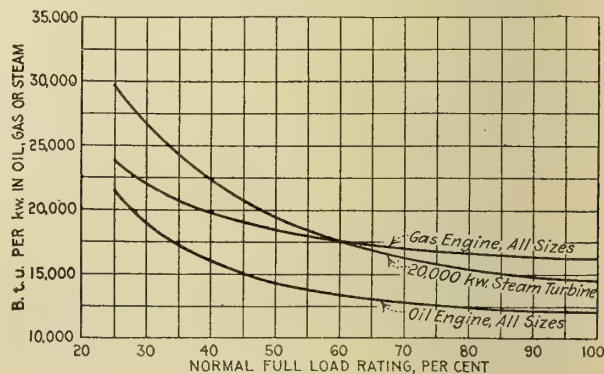


Fig. 8.

twin-tandem Diesel engine operating with tar oil, which promises interesting results.

**Efficiency.**—The thermal efficiency of the oil engine varies slightly with the capacity. Unlike the gas engine, the thermal efficiency does not increase with the load beyond the capacity of the engine.

Figures of efficiency have been given at different times that cannot be substantiated. With oil having 19,000 B.t.u.'s (4,788 large calories) per lb., the thermal efficiency and fuel consumption that may be expected at different percentages



of normal full load rating, no allowance being made for auxiliaries, are shown in Fig. 9.

At full load the fuel consumption is 0.64 lb. per kw.h. or 0.45 lb. per brake horse-power, and the thermal efficiency 28.2 per cent per kw.h., or 29.8 per cent per brake horse-power.

The fuel consumption of the best oil engines to-day, made in large sizes, varies from 0.40 to 0.50 lb. per brake

factory. Fig. 12 gives the average total cost per kilowatt for all sizes at \$95 per kw., also the cost per pound, which decreases but slightly for machines above 160 kw. capacity.

Important improvements in the construction of the vertical type Diesel engine are being made in this country, as well as in Europe, which will probably reduce the weight and consequently the unit cost.

The average total cost, average cost per kilowatt, and average cost per pound of two and four-cycle, horizontal, crude-oil engines, American manufacture, including engine and generator, are shown in Fig. 13, corresponding to the weights given in Fig. 11.

There is considerable variation in the weights and costs of the horizontal type oil engines of the different manufacturers, and for this reason the average curve is given instead of the maximum and minimum. The weights and costs are fairly consistent for the single cylinders or all sizes, the greatest difference being with the twin and four-cylinder types. These curves hold fairly well for the so-called semi-Diesel horizontal type.

### Hydraulic Turbines

The development of hydro-electric power installations has created new demands on the designers and manufacturers of hydraulic turbines for betterments in efficiency, power,

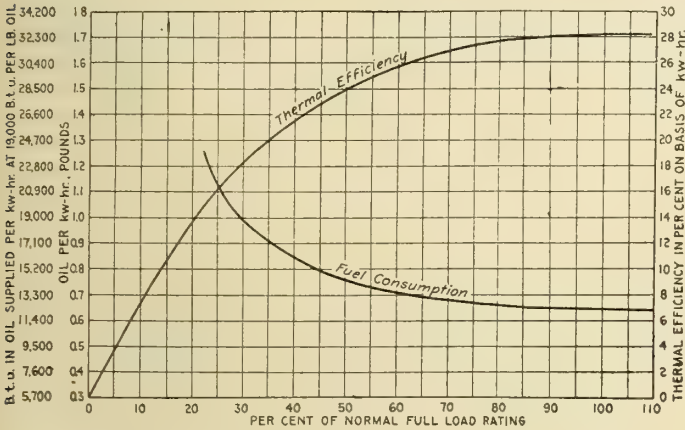


Fig. 9.

horse-power, the highest fuel economy being obtained by the four-cycle type.

**Weight.**—The Diesel engine is inherently massive for the same reason as the gas engine, namely, high temperatures and pressures, consequently the weight, including engine and generator per kilowatt capacity increases with the size, as shown in Fig. 10.

It will be seen that the increase in weight from 40 to 160 kw. capacity is very rapid, while with sizes larger than 160 kw. it is not so pronounced.

High-compression Diesel-cycle crude-oil engines of the two and four-cycle, single and twin-cylinder, horizontal type, using a heavy grade of crude oil, are now being manufactured in America as large as 500 h.p. capacity, some companies standing ready to construct units of 800 h.p. capacity

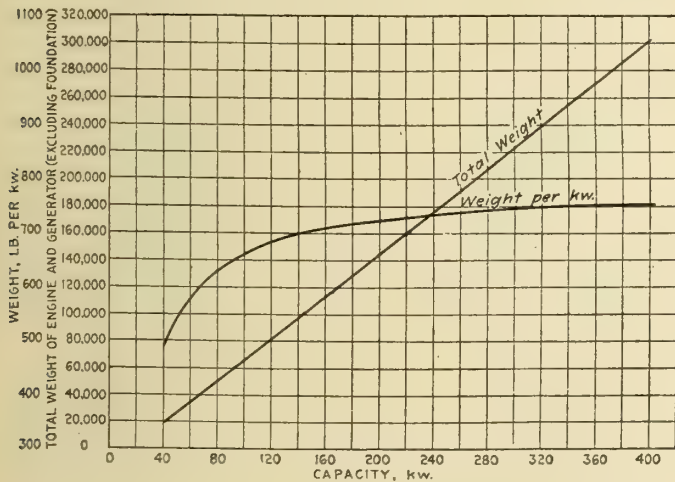


Fig. 10.

if required. Fig. 11 shows the average total weight and weight per kilowatt capacity for these machines.

**Cost.**—There have been so few oil engines driving generators of any appreciable size installed in this country that it is a difficult matter to tabulate any costs for comparative purposes with other prime movers. The most reliable figures available for the Diesel engine average approximately \$95 per kilowatt installed, including engine and generator complete, but not the foundations, within 600 miles of

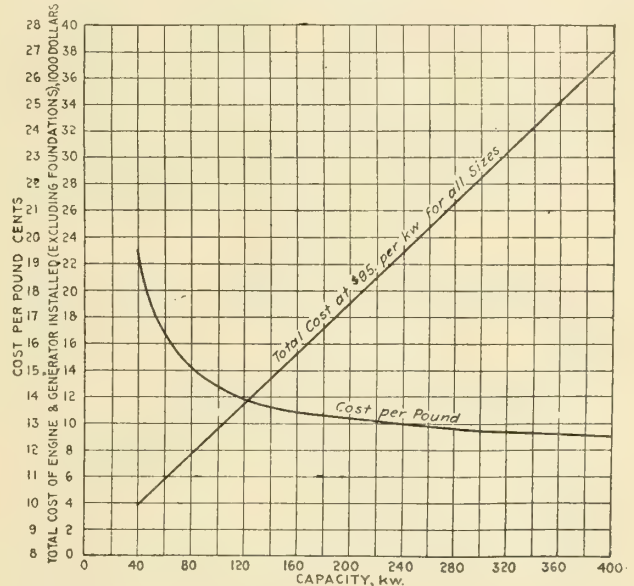


Fig. 11.

speed, strength and size of turbine runners. of small importance, but as the demands for power increased, and the capacity of sources of water supply became over-taxed, high efficiency became of importance.

In the case of modern hydro-electric developments, there are few sources of supply so great that the efficiency of the installed machinery is not of the highest importance. The demand on turbine designers and manufacturers for increased efficiency has been met by better design, better construction, and better finish; and as a result, the efficiency of turbines has been so increased that in the case of at least four different manufacturers, efficiencies of 90 per cent or over have recently been obtained at the hydraulic testing flume at Holyoke under the best conditions of gate, speed and head; and high efficiencies can now be maintained through considerable variations both of head and power, as will be seen by reference to Fig. 14.

Recent tests at Holyoke on a high specific speed 28-in. vertical Francis type turbine, the results of which are shown in Fig. 15, represent the best that is being accomplished at the present time.

It will be seen that the efficiency remains fairly constant through a considerable variation in power. The effi-



ciency at 90 per cent gate opening is 91.5 per cent and at full gate it dropped to 84 per cent.

For direct connection to comparatively high-speed electrical machinery, both capacity and speed, together with high efficiency, are common demands. A comparison of the power capacity of various types of wheels can best be made on the basis of the power of the unit wheels of the various types under the unit head. This unit power is represented by the equation

$$P_1 = \frac{P}{D^2 \sqrt{h^3}}$$

$P_1$  is the unit power of the unit wheel of the type considered under unit head.

$P$  is the power (h.p.) of any wheel under the head  $h$

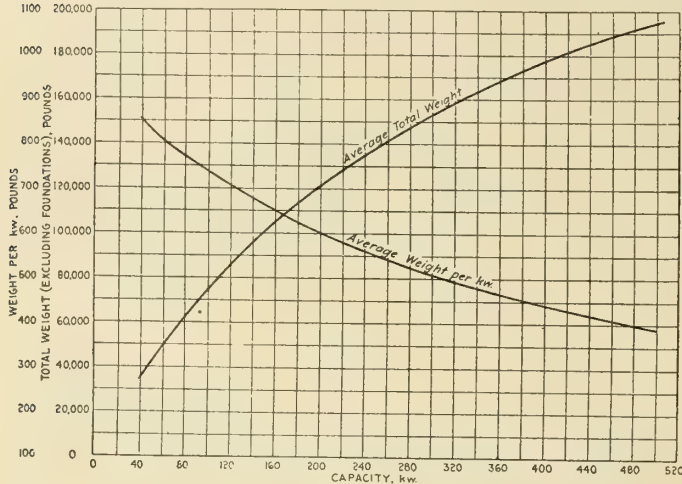


Fig. 12

$D$  is the diameter in inches of the wheel considered,  $h$  is the head in feet under which the power ( $P$ ) is developed.

In each case the best conditions of speed and efficiency are assumed to obtain.

In the original Boyden-Fourneyron turbine of 1849, the value of  $P_1$  was equal to ..... 0.00032  
This was increased by Swain in 1855 to ... 0.0008  
By McCormick in 1860 to ... 0.0014

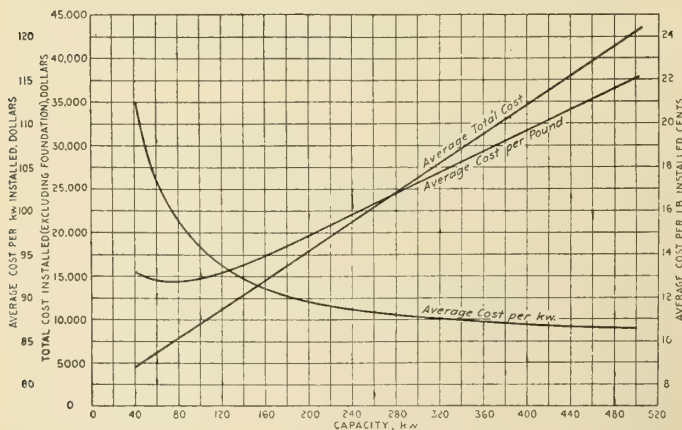


Fig. 13.

By a number of recent designers to values from ... 0.002 to 0.0024  
And has been extended to ... 0.00388

in a recent design, without a reduction in efficiency below 87 per cent, an enormous increase in power which is quite worthy of note.

Capacity and speed are both often highly desirable for electric machinery if both can be extended without too great a sacrifice in efficiency. The combined capacity and speed

may be compared by the speed power coefficients of the various types (see page 1409, Vol. XXXI., Transactions A.I.E.E.), which may be termed the "specific power" of the wheel, and which is represented by the equation

$$P_s = \frac{n^2 P}{\sqrt{h^5}}$$

in which  $n$  = the revolutions per minute of the wheel under the head  $h$  and with the horse-power  $P$ . The speed power coefficient  $P_s$  is the square of the coefficient of unity speed.

The value  $P_s = 10,000$  had barely been reached in 1910, but during the present year a designer has succeeded in increasing the value to  $P_s = 11,800$ .

Such wheels are frequently of high value for low-head and high-speed conditions, but cannot maintain such high efficiencies under great ranges of head and loads as can be maintained with wheels of lower "specific power," such as are shown in Fig. 14.

Among the more recent improvements in the construc-

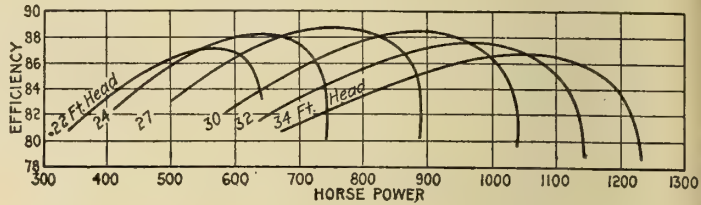


Fig. 14.

tion of hydraulic reaction turbine runners may be mentioned the construction of high-capacity runners of cast steel in single castings, thus giving great strength with large capacity under high heads to which such turbines could not previously be applied.

The recent successful construction of the large single reaction turbines for the Keokuk hydro-electric plant is also worthy of note. These turbines are 16 ft. 2 in. in diameter and operate at 57.7 revolutions per minute under a 32-ft. head. The runners weigh 73 tons each and develop 10,000 h.p. While greater power has previously been developed by single wheels under high heads, these wheels are remarkable for the amount of power developed under the low head utilized.

Since 1911, the trend has been toward the adoption of the single-runner, vertical-shaft turbine for low and medium heads. This change in type of unit is due to the recent pro-

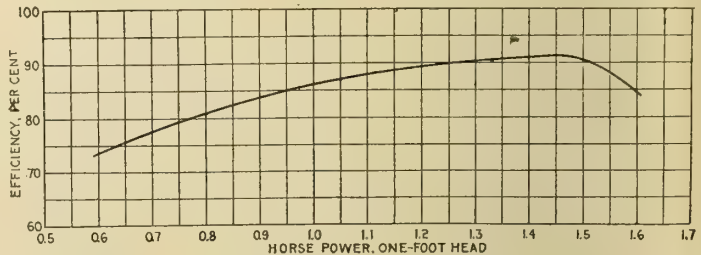


Fig. 15.

gress in the design and development of high-capacity runners also the improvement in thrust bearings.

Prior to this time, the majority of turbines for low and medium heads were either of the vertical-shaft, multi-runner type, or of the horizontal-shaft, multi-runner type.

Weight and Cost.—The weights and costs of hydraulic prime movers are not strictly comparable with the steam turbine, gas and oil engines, for in the case of the thermodynamic prime movers, the conditions are more or less fixed and the costs relatively uniform, whereas with the water turbine they vary between fairly wide limits, depending upon the conditions under which they are to be operated. The head, kind of flume, open or closed, setting vertical or hori-

(Concluded in Aug. 15 issue.)



# Electric Railways

## Employees' Accident Insurance

Traction companies are particularly interested in the subject of accidents and workmen's compensation. It is doubtless for this reason that railway companies, both steam and electric, have been quick to see the advantage of the Safety First movement and have, by every means in their power, furthered attempts to reduce accidents and fatalities on or adjacent to their lines of traffic. The Workmen's Compensation Act which is about to be set in motion in Ontario will depend for its smooth administration very largely on the extent to which the Safety First movement has developed and its teaching taken to heart by the average employee. In parts of the United States a very similar condition exists and it is interesting to note that the railway companies are making the administration of the act as easy as possible and are even taking steps in advance to provide for its amicable and effective working. In this connection an interesting paper was read by Mr. Jas. H. Hoey, second deputy superintendent of insurance of the State of New York, before the annual meeting of the New York Electric Railway Association. This paper speaks of a number of instances where remarkable progress has been made in furthering friendly relationship between employer and employee through co-operation and better understanding. An abstract of this paper follows:—

The Workmen's compensation law in the State of New York provides not only for damages on account of injuries but also for medical service for injured employees during the time of disability. It is refreshing to see that the great organization with which your president, Mr. Hedley, is identified has taken the initiative by providing in advance for this important service. The Interborough Rapid Transit Company has arranged with doctors and hospitals for the care of its injured employees. It has also worked out a scheme which bears the earmarks of care and study. When a man is injured he reports at once to the first-aid man, a fellow employee, at a terminal shop or power house. It is this man's duty to give the proper first-aid treatment, and then send the injured man either to a local doctor or, if the injury is trivial, back to his work. If further treatment is needed, the employee continues to visit the doctor as often as necessary, and if necessity arises he is sent to a hospital. In the hospital he does not become an ordinary ward patient but is sent to the semi-private ward where he can see friends and relatives at reasonable times and where he does not have to incur the stigma that attaches to a charity patient. If his injury requires special treatment, he will obtain the services of a specialist. At the central hospital massage, baths, electricity and the like will be provided to treat those who have become victims of rheumatism or other ills common to the workman who is exposed to the weather. All these go to make a strong link in the magnificent scheme for the conservation of human life.

The country is now entering on an era of economic conservation of life and property. Yet while science has been searching out and destroying the older enemies of man, invention has not provided safety appliances to keep

pace with its own creations. Every man injured by a railroad and improperly compensated becomes an agent of discontent among his fellow men, with whom the railroads in the last analysis will have to reckon. Every inadequate piece of rolling stock becomes a piece of evidence in the indictment against efficiency. Every unprotected mile of roadbed makes for the propagation of the spirit of ill-will towards the company that maintains it.

To accomplish safety, to bring it to its highest state of perfection, organization is needed. The schools also must be utilized, and the young people taught what to do and how to do it in order to protect themselves. Yet a higher duty devolves upon the railroads, a duty which must find its practical expression in the adoption of the most up-to-date methods of safeguarding life and limb.

The disposition of woman, for example, to use her right hand in alighting from a street car cannot be corrected in a day. You cannot correct this disposition by any number of educational pictures. The trouble is too deep for such a superficial remedy. The evil can only be obviated by providing a means which makes the use of the right hand under the circumstances unnecessary or impossible, and by instituting a radical and thorough system of education. You can begin with the young girl in school. You can train her to acquire proper habits; you can teach her how to use her hands in order to protect herself. But the process of education has to be undertaken before the habit predicated on a natural tendency is acquired.

The most necessary of all educational work, however, is the education of your own employees. Every motorman, every conductor, every trainman is familiar with the causes of accidents. Many of them have worked out in their own minds methods by which these accidents should be avoided. Experts tell us that only 15 or 20 per cent of the accidents caused by machinery can be prevented by the adoption of mechanical appliances. It follows, therefore, that if we are to cut the number of accidents in half, the remaining 30 or 35 per cent must be prevented by means of education.

In the old days conductors and other employees of railways received bonuses based on the amount of their collections and the time made on each trip, and more recently they were rewarded for their economic use of electricity. In the future they will get rewards for minimizing the number of accidents. Such a system has been established by the United States Steel Corporation and remarkable results have flowed from it. Each mechanic is given to understand that every scheme of safety he invents to make the operation of his own machine safer is going to be recognized by the payment of periodic bonuses for the prevention of accidents. This is a plan which steam railroads and electric railways can copy with advantage.

Safety is going to be the watchword of the next decade. Safety is economy. The railway which does not adapt itself to the new idea will run the risk of having its property condemned and turned over to public ownership and operation. The country is not ripe for this step, but the public is sometimes impatient. Such impatience can be controlled by good service by the companies and in no other way.



# Illumination

## Semi-Indirect Lighting

In the production of good illumination, whether in the home, factory, office, or other public buildings, it is generally recognized that very much depends on the location of the units and the kind, number and capacity of the light sources. Equally important however is the selection of proper glassware, for herein consists largely the control of the light—whether it shall be patchy or evenly distributed; glaring or restful; irritating or harmonious; inadequate or ample for the specific requirements.

Such phenomenal progress has been made in the economical production of light during the immediate past that this phase of illumination has tended to overshadow the equally important question of distribution. It is plain however that with the developments in the one the necessity for the other becomes still more urgent, as, without proper control, the more brilliant light sources, are, excepting in rare cases, of little advantage.

The method of control of light generally divides itself into three classes: 1st, direct; 2nd, indirect; 3rd, semi-indirect.

The actual definition of or dividing line between these three classes has been the cause of a considerable amount of

Indirect unit: A lighting device from which all the light emitted is projected to the ceiling or walls and from there reflected to the object to be lighted.

Whether direct, indirect or semi-indirect illumination is best in any particular case can not be determined without

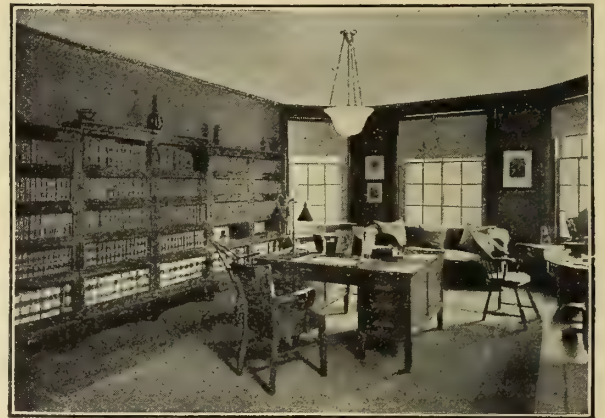


Fig. 2—Private residence lighting.



Fig. 1—Toronto Public Library.

argument and discussion, but it now appears as though the following definitions were being recognized as standards. They have been recommended by the Research Committee of The Illuminating Engineering Society of the United States, who have made a careful study of the matter, and will probably be adopted in the near future by that society:—

Direct unit: A lighting device from which more than half the emitted light is directed downward or to the side, reaching the surface to be illuminated without being reflected to the walls or ceiling.

Semi-direct unit: A lighting device employing a diffusing or translucent medium which directs more than half of the light to the walls or ceiling to be re-directed for use, the remainder of the light being diffused through the medium.

careful study of the conditions surrounding the installation and the requirements of it. It is very important that no prejudice should be allowed to enter into this decision as undoubtedly each system has its place and is most suitable under certain conditions.

In our recent issues we have described a number of installations of direct and indirect illumination. We are

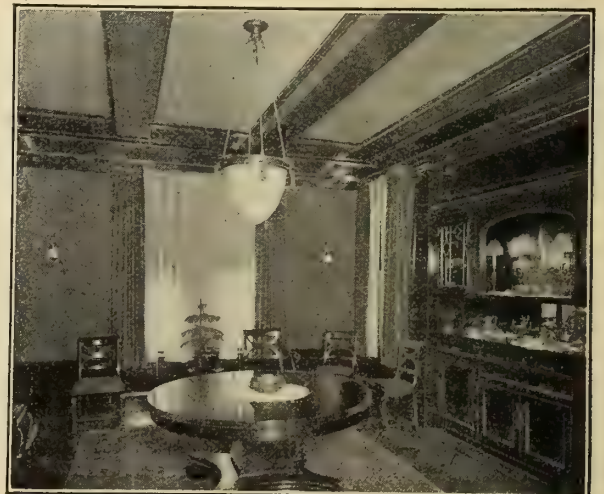


Fig. 3—Dining room, Montreal.

illustrating in the present instance a number of interior illuminations by semi-indirect units and we are also showing three or four typical productions of the type of handsome glassware which is now being sold throughout Canada by a number of firms. For the particular cuts shown we are in-



debted to the Toronto office of the MacBeth-Evans Company.

Figure 1 is a view of a corner of the Toronto Public Library lighted by semi-indirect units. Alba glass is used and the effect is pleasing and restful, while at the same time ample illumination is provided for readers.

Figure 2 represents an installation in a private library of a prominent citizen of one of our Ontario towns. For reading purposes this unit was found to give a highly satisfactory distribution with a minimum of strain on the reader's eyes; also, the general effect is restful and soothing.

Figure 3 represents a semi-indirect installation in a private dining room in the city of Montreal. It is of Decora glass, Adam style and is one of the handsomest as well as one of the most satisfactory semi-indirect units that has yet been produced.

Figure 4 represents a standard semi-indirect unit, Ionic design. In many of these fixtures the upper single chain is discarded. The three suspensions running right up to the ceiling. This type of fixture is especially popular where the unit is only suspended a short distance from the ceiling.

Figure 5 is a unit specially designed for the new nitrogen lamp and is adapted for public buildings of all sorts.

Figure 6 represents an ornamental enclosing globe suitable for auditorium or other buildings where the decorative features are prominent.

Figure 7 is also a highly decorative unit suitable for corridors or similar rooms where the decorative features are given unusual prominence.

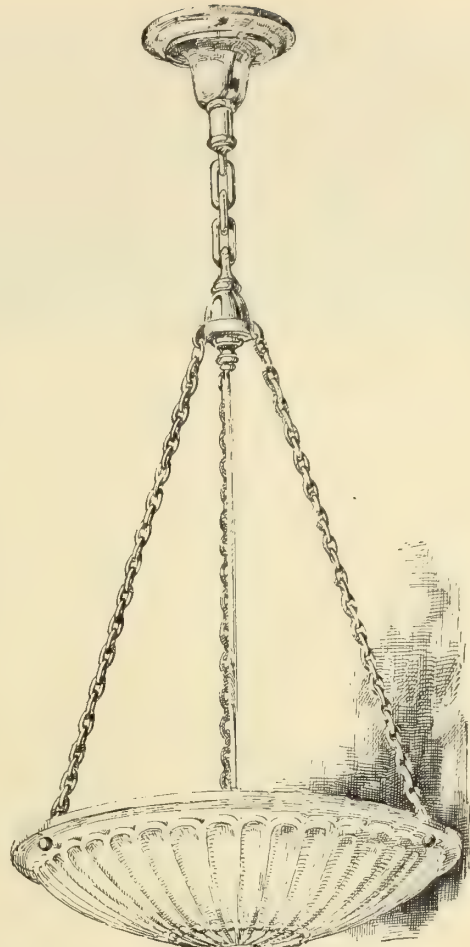


Fig. 4



Fig. 5

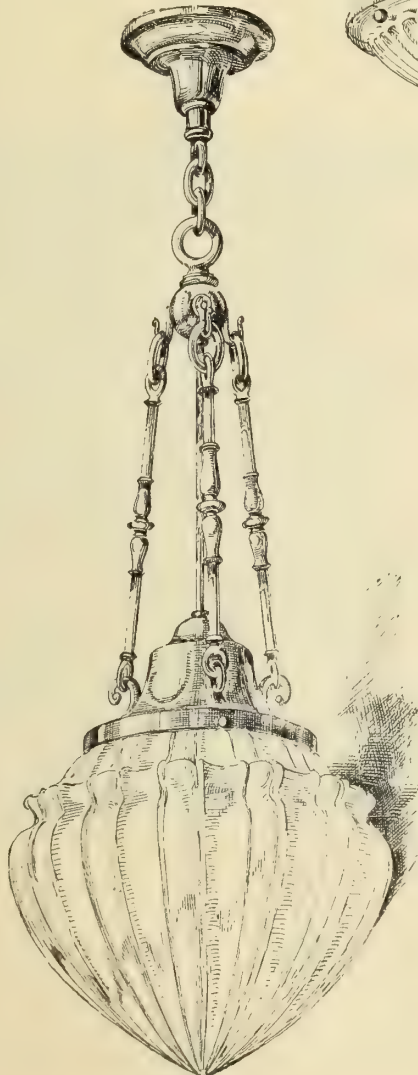


Fig. 6

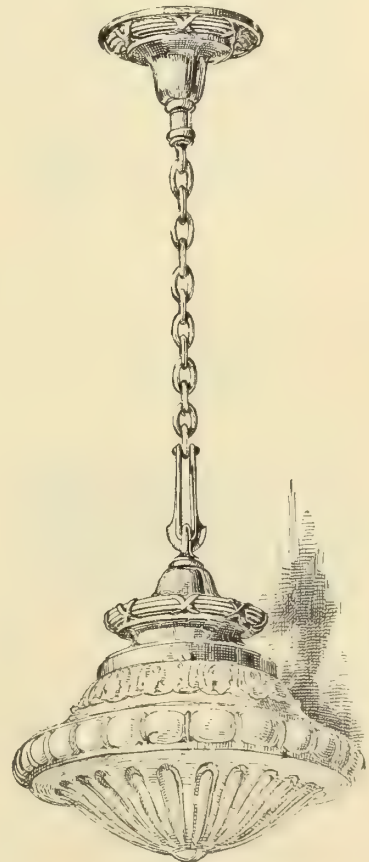


Fig. 7



# The Dealer and Contractor

## Standardization in Electrical Contracting

One of the most important pieces of work before the Electrical Contractor of the present day appears to be an agitation towards the standardization both of electrical equipment and its method of installation. Why, for instance, has the common outlet box not been standardized, both as to size and construction so as to accommodate all makes of switches. This has been accomplished to a certain extent it is true, and the manufacturers who hold out against standardization may feel that they stand to gain by maintaining a standard of their own, since when replacements and renewals are required, other makes of equipment cannot be used. On the other hand there can be no doubt that both the electrical contractors and the consumers are often greatly inconvenienced by the lack of standardization, and we believe every effort should be made towards a reasonable degree of standardization of equipment.

Standardization of construction methods are even more necessary from the consumer's point of view. At the present time it is either necessary for a householder, for instance, to be personally acquainted with his electrical contractor or to employ a firm with a very wide reputation. The employment of an electrical contractor which one may get in touch with through his advertising or the sign on his door, is to court imperfect, and probably unsafe, methods of installation. It is true the system of inspection generally employed tends to keep the work up to a certain standard, but an electrical installation is of that peculiar type which makes it possible for unscrupulous contractors to defeat the ends of municipal or other inspection, without much fear of detection. The standardization of installation methods may not remove the evil, but it would go some distance towards it.

In a recent issue of the National Electrical Contractor a plea for standardization is made by Mr. C. F. Butte, and in an interesting article which we reproduce in abstract, Mr. Butte considers that conditions would be ideal if all competitors figured all work on the same basis, and installed accordingly. Right here there seems to be a big work for the electrical contractor, which can only be accomplished by co-operation.

In certain local centres much has already been accomplished, but the need of a larger and more representative organization seems very necessary.

"It will not be the endeavor of the writer to dwell on this subject in any lengthy detail as to the courses to pursue, or to the methods to be adopted, owing to the limited space, but merely to write in a suggestive manner giving food for thought and depend upon the reader to apply, or develop any of the ideas that may be brought out.

Standardization is the keynote of all large industries in the present period, with the one aim in view: increase product, decrease cost and raise the quality and standard of the various articles that are made.

Scientific shop management is now on a well recognized basis, and the scientific engineer who continuously

strives to standardize and reduce efforts is always in demand.

Why should not the electrical contractor standardize his work?

Why does one contractor install his work in one way and another contractor some other way, when the same construction should be used in both cases? Unquestionably, many of you have seen typical cases of this kind and wherein considerable cost and expense could have been saved the contractor and a better grade of work would have resulted had some previous standard been adopted for such work.

Standardization of panel boards, main switchboards of certain classes, meter panels, construction details, material forms, estimating methods and the many various details of the contractor's work, would unquestionably aid the contractor, minimize his efforts and work, thereby increasing his capacity, reduce the possibility of errors, educate and make his workmen more efficient, increase his profits by reducing any uncertain factors. It may be said that standardization would destroy individuality, but is it not an admitted fact that individuality is sometimes rather expensive, both to the individual contractor and to the contractors as a whole, competing for the same work due to incorrect figuring, inefficient and poor methods? Would not the ideal conditions exist if all competitors were on the same basis and figured on the work similarly?

As stated previously, it is not the intention to dwell in detail as to how or wherefore, but the writer would suggest that each of the various local contractors' associations take up the work of standardization in their localities, possibly starting with forms and blanks and gradually adopt standards for all the various details of construction.

Some readers may be somewhat skeptical as to the possibilities along these lines. In order to offset any argument along the skeptic's lines, let us dwell on what has been done by others. Not many years ago a machinist had considerable trouble with machine screws, machine bolts, drills and tools on account of the many various gauges, threads and sizes. Does he have the same difficulty at the present time? No, as the manufacturers have standardized.

Does the plumber have to buy Smith's or Brown's fittings to install his work? No, as the fittings are standardized. Many more similar cases can be cited wherein chaotic conditions have been corrected by standardization, but space will not permit."

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The operation returns of the municipal street railway system, Regina, for the week ending July 11th are as follows:—Revenue, \$4,002.60; passengers carried, 94,825; passengers carried including transfers, 107,505.

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The eighth annual convention of the Illuminating Engineering Society will be held in Cleveland, September 21-25 inclusive at the Hollenden Hotel. The Hollenden is an ideal location for convention purposes, having something like 40,000 sq. ft. of ground floor space and accommodation for 800 guests.



### Low Voltage Lighting Plants

The need of electric light, in isolated localities not reached by Central Station lines, has long been felt, and has been one of the deterring influences in the re-trend of population from city to country. The safety, cleanliness and convenience of electric light is so generally recognized also, that there is every incentive to make it universally available. Abundance of light can no longer be classed as a luxury, but must be considered as a necessity to home comfort, within the reach of every moderate income.

With these facts in view, the Northern Electric Company has recently placed on the market, a low voltage lighting outfit, consisting of a storage battery, generator, gasoline engine and switchboard, for operation at 32 volts. The company recommend that for the successful continuous operation of a lighting outfit, of small capacity, it is better to have a storage battery that will take the bulk of the lighting, instead of relying upon the generator entirely for the electrical energy necessary. By so doing, the user obtains an absolutely steady voltage at the lamps and does not have to purchase a special electric engine for close speed regulation, which is comparatively expensive. They do not advise the purchase of a rubber jar battery for this service since the cell is entirely enclosed and does not offer a means of easy inspection of the plates and condition of the electrolyte, as is obtained with a glass jar battery. This is claimed to be an important feature, liable to be overlooked by the buyer who does not discriminate and who is too easily attracted by the slightly lower first cost of a battery in rubber.

In accordance with these facts, all this company's outfits have been designed to incorporate a storage battery in glass, of sufficient capacity to furnish all the electrical energy

latter case, since the charging voltage is always higher than normal voltage obtained from the battery.

A feature of the outfit is that when starting up the set, the generator may be run as a motor, using battery energy to turn over the gasoline engine. It is therefore unnecessary to turn the engine by hand, as is generally the case, when using the commercial types of small gasoline engines.

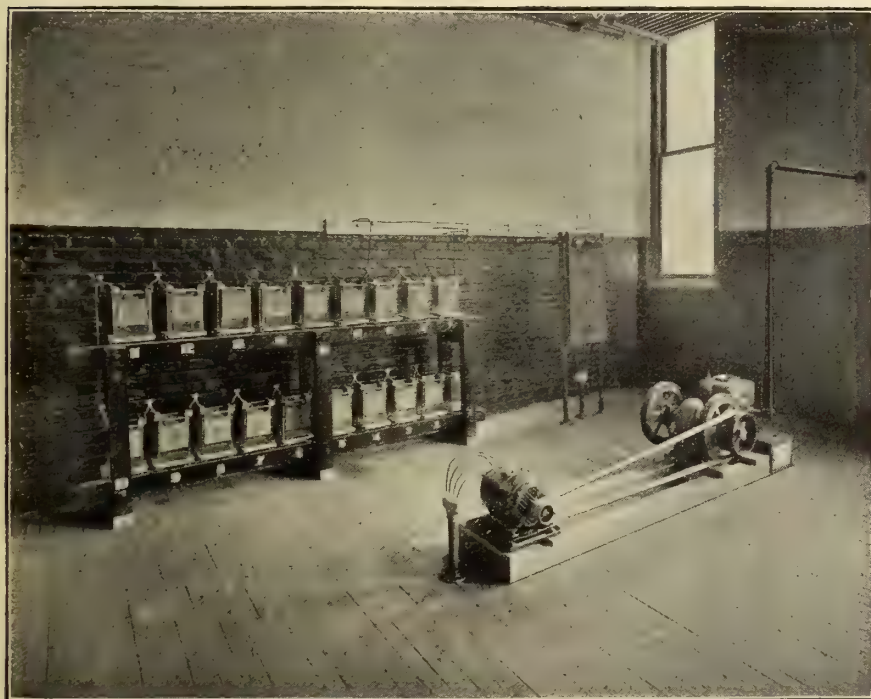
The switchboard is equipped with an underload circuit breaker, which shuts down the engine automatically when the battery becomes fully charged. This is accomplished by having the ignition circuit of the engine excited by the counter e.m.f. cells of the battery.

Besides using the outfit for lighting service, any household electrical device wound for 32 volts, may be conveniently used if the capacity of the battery is selected with that end in view. The owner of such an outfit can therefore enjoy the conveniences of the electric fan, iron, coffee percolator, toaster, vacuum cleaner, washing machine, etc., available for instant use at any time.

The low voltage lighting outfits are furnished with a special make of gasoline engine, which is characterized by its economy in fuel consumption, so that the cost of operation will figure down to approximately one cent to burn a 20 watt, 16 c.p. tungsten lamp for five hours.

### Attachment Plugs and Receptacles

The three-wire attachment plugs and receptacles illustrated herewith are being manufactured by Harvey Hubbell, Inc., Bridgeport, Conn. In Fig. 1 is shown a separable attachment plug which is rated at 660 watts for 250-volt circuits. The cap for this plug is made entirely of porcelain or of porcelain with a brass cover. The wall receptacle shown in Fig. 2 and the flush receptacle in Fig. 3 are rated at 10



A complete lighting plant for out-of-town requirements.

required; the generator being used only for charging purposes. However, should the user desire, he may operate the battery and generator in parallel to obtain the combined capacity of both, which is accomplished by merely throwing a switch on the board; or, he may charge the battery while using current for lights or other purposes. Counter e.m.f. cells are provided to keep the line voltage normal in the

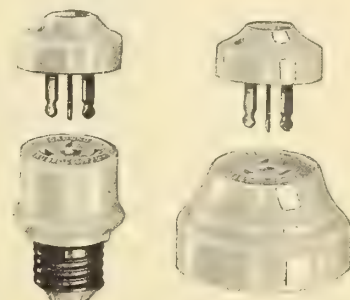


Fig. 1

Fig. 2

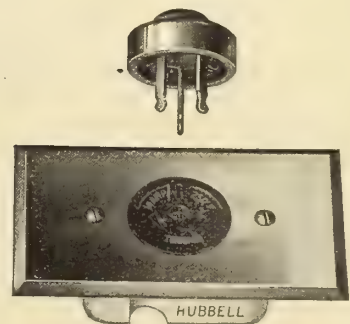


Fig. 3

amp. for 250-volt circuits. These plugs and receptacles are of the polarized type, making it impossible therefore, to reverse the polarity. They may be used with electric stoves, portable motors, etc.

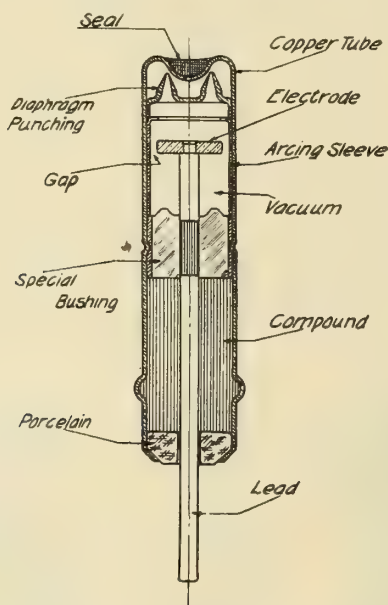
The Ricetown Rural Telephone Company has awarded contract for an installation to cost some \$13,000.



### Vacuum Tube Lightning Arrester

A new arrester specially designed for railway signal circuits is being placed on the market by the Canadian General Electric Company. The two vital requirements in a lightning arrester for this particular service consist, 1st, in a low spark potential, and 2nd, in freedom from short circuits following lightning discharge. The first of these requirements demands a small spark gap; the second a larger one. By surrounding the larger gap with a vacuum, both requirements are met. In other words, the larger gap prevents short circuit, while the vacuum reduces the spark potential to a value much below what it would be in air and sufficiently low to afford protection. The new arrester is constructed of a metal tube with metal electrodes; this construction being finally chosen, after much experimenting, because, considering all requirements, it affords the best protection.

The arrester is essentially a gap in a vacuum. For the general internal construction see the accompanying illustration. The gap is formed between the inner wall of a drawn metal shell and a disk electrode mounted concentric with it. The electrode is supported on a brass rod 3-32 in. diameter,



Showing internal construction of arrester.

which serves as the lead-in connection, and has ample current-carrying capacity. The electrode system is insulated from the tube and rigidly supported in position by a bushing made of a special, accurately-molded, vitreous material which is unusually strong and able to withstand sudden changes of temperature. The bushing does not form the vacuum seal, however, that being made by a compound specially developed for the work. The open end of the tube is finally closed by a porcelain bushing held in place by spinning.

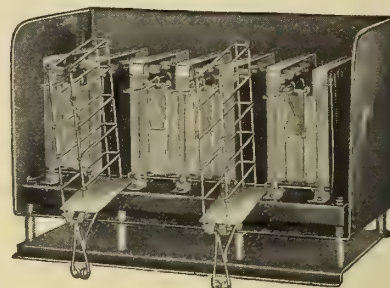
The tube is exhausted in a special machine which solders a small hole in the end after the vacuum has been established. The possibility of solder entering the active part of the vacuum space is prevented by a diaphragm punching, and both the electrode and the lining of the tube are of non-arcing metal.

The arrester has a spark potential of from 350 to 600 volts direct-current, and an equivalent-needle-gap of about 0.005 in. It will discharge the heaviest strokes of lightning without damage to itself, the necessity for maintenance, or the possibility of short circuit. This was proven by tests at currents as high as 1,000 amperes, using a circuit breaker, and also from the repeated blowing of 35 ampere fuses on a 500 volt trolley circuit. It will not stand a continuous flow of current due to excessive heating. If there be a possi-

bility of this due to high potential crosses, fuses must be provided.

### Electric Toasting in Large Buildings

Toasting in hotels and restaurants makes a heavy, but intermittent demand on the kitchen equipment. Guests usually want their toast in a hurry and it must be served hot and fresh. Toasting a slice of bread properly is a short operation, but requires high temperature. The toaster illustrated herewith is capable of toasting six slices at once and



Large electric toaster.

is one of the most satisfactory devices available for the purpose. The coils grow red the instant the current is turned on and the switches are so arranged that two, three or six slices can be toasted economically and simultaneously in one minute. As will be noticed, the slices to be toasted are placed in hinged wire racks which are then tipped back into the toasting position between the heating elements. These elements, of which there are seven, are each composed of four vertical coils mounted on strips of mica. The coils are of Calorite wire noted for its durability. The sheet metal sides and back of the toaster act as a shield, preventing draught of air which might cool the coils. Two controlling switches of the "on" and "off" indicating type are furnished and are intended to be mounted on the wall at a point convenient to the toaster. One switch controls three heating units, and the other four units. The toaster illustrated is being placed on the market by the Canadian General Electric Company.

### A Ten-Mile Cable

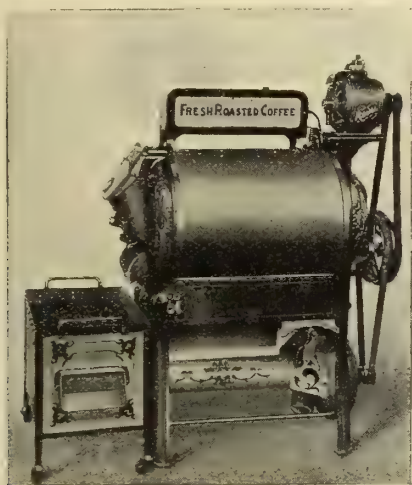
The telephone cable recently laid by the Dominion government connecting Halifax, N.S., with Charlottetown, P.E.I., was constructed in the cable works of the Siemens Company in England and was shipped to Halifax in one continuous length of ten nautical miles. The cable consists of four gutta percha insulated conductors, two of which will be used to make one telephone circuit; the remaining conductors will form two independent telegraph circuits. These four conductors are "cabled" together with prepared jute yarn and further covered with the same material to form a bedding for the armouring which consists of a sufficient number of galvanized soft iron wires of such a size as to give ample mechanical protection to the cable, having in view the local conditions of the neighborhood in which the cable is laid. The armouring is further protected by layers of tarred jute yarn and compound. This submarine cable is of the "loaded" type, the load coils being inserted at regular intervals; by this device from 2½ to 6 times the efficiency of the ordinary submarine cable is obtained.

On July 9 the strike which was declared some time ago among the employees of the Westinghouse Company at East Pittsburgh was called off by the men. Although the day set for returning to work was Monday, July 13th, a large number of the men reported on the Friday and Saturday preceding. The works have been running since July 14th at full capacity.



### A Coffee and Peanut Roaster for the Retail Trade

Every one handling coffee knows that freshly roasted coffee is much better than that which has been roasted for some time, and those retail dealers desirous of serving their customers with the best have always been anxious to secure some means of roasting their own coffee. Heretofore, however, coffee roasting machinery has been so bulky and expensive that only wholesalers and others handling coffee in large quantities were able to install it. The Royal coffee



Coffee roaster.

roaster, made by the A. J. Deer Company, Hornell, N.Y., was developed to permit retailers to secure the advertising possibilities arising from supplying their trade with fresh roasted coffee. This machine is small, compact, and so simple in operation that any clerk can use it. The coffee is placed in a cylinder which is surrounded by a jacket and revolved by a Westinghouse Electric motor. Here it is subjected to the heat of a gas or gasoline flame, and when roasted, is dropped into a movable car where it is quickly cooled by means of an air blast. The style illustrated has a capacity of 25 pounds of coffee; its overall dimensions are: height, 4 feet 8 inches; length, 4 feet 8 inches, and width, 3 feet 4 inches. It will roast 100 pounds of coffee at a cost of 18 cents. This covers cost of the current for the Westinghouse small motor and for the gas for the flame. The Royal roaster is also suitable for roasting peanuts.

### 46,000 Volt Cable

The Siemens Company of Canada have recently supplied a quantity of 46,000 volt cable to the Union Carbide Company, Niagara Falls, Ont. This cable is of peculiar construction having been designed to overcome the electric stress which would be greater than the dielectric stress of the innermost layer of the insulating material if the conductor were of the ordinary construction, the diameter of the latter being smaller than is allowed by theory. In order to obtain the necessary safe diameter for this cable the conductor has been formed by arranging the correct number and size of copper wires, to give the required cross-section of cable, around a centre of prepared jute yarn, and covering with a thin tube of lead as a further protection and to give the conductor a perfectly smooth appearance.

### Trade Publications

**Motor Car Accessories**—Folder issued by the Canadian General Electric Company describing Adams-Bagnall electrical accessories for motor cars.

**Carbureters**—Booklet issued by the Canadian General Electric Company describing and illustrating carbureters, flexible tubing, motor specialties, etc.

**Knife Switches**—Bulletin No. 41 issued by the Canadian Krantz Electric & Manufacturing Company illustrating and describing their commercial grade knife switches.

**Governors**—Bulletin No. 44590, issued by the Railway Department of the Canadian General Electric Company, Limited, describing and illustrating type ML governors for motor-driven air compressors.

**Graphic Instruments**—Catalogue No. 321 issued by the Esterline Company, Indianapolis, illustrating and describing the Esterline curve drawing instruments. The catalogue contains very complete information on the construction, rating, consumption, etc., of these instruments.

**High Voltage d.c. Equipment**—Bulletin No. 44010 issued by the Railway Department of the Canadian General Electric Company, describing and illustrating the high voltage direct current equipment of the Pittsburgh and Butler Street Railway, which has now been operating for several months.

**Westinghouse**—Current publications include No. 8 of the Westinghouse Railway Data Exchange which contains information on "Efficient use of Cars" and "Cost of Stops"; a little booklet entitled "Drawing the Crowd and Keeping It"; and publication No. 1531 describing the wicker type electric linotype pots.

### Sturtevant Vacuum Cleaners to be Sold in Canada

The B. F. Sturtevant Company of Canada, Limited, Galt, Ontario, intend marketing their vacuum cleaners in this country. These cleaners are sold very extensively in the United States under the name of the Western-Electric-Sturtevant vacuum cleaner. The B. F. Sturtevant Company are planning a vigorous campaign and are looking for agents in all the towns and cities where electric power is available.

### New Companies

The Huntsville & Lake of Bays Telephone Company has been incorporated with \$4,000 capital.

The Canadian Storage Battery Company has been incorporated with head office Toronto; capital \$40,000.

The International Light and Manufacturing Company of Canada, Limited, has been incorporated with capital \$150,000; head office Regina, Sask.

The City & Suburban Motorbus Company, Limited, of Toronto, has been incorporated with \$250,000 capital. The name of J. R. L. Starr, barrister, appears as the incorporator.

(Concluded from page 50.)

This hardware follows closely that already described for lower voltages.

The grounding straps shown on plate 34 are to be sheared, punched, formed and rivetted before galvanizing, in order that all exposed edges may be protected. They are held close to the cross-arm by driving in ordinary 1-inch galvanized roofing nails, holes being provided for this purpose.

In submitting this report for your consideration your committee have endeavored to eliminate the many types of "freak" construction and to suggest a good substantial line of fittings which can be utilized to economical advantage on construction where long life, permanency and reliability are of more importance than keeping the actual first cost at an absolute minimum. We believe that the types illustrated will result in an annual upkeep and overhead cost far below that obtainable by any construction where first cost is given sole consideration.

We trust we may have your approval of this work and that many, if not all, of the fittings shown may become standard with member companies in the near future; and until such time as the development of the art brings out ones of proven better design or utility.



# Current News and Notes

## Bolton, Ont.

A by-law will be submitted on August 3rd authorizing the council to enter into a contract with the Hydro-Electric Power Commission of Ontario for the supply of electric energy.

## Brantford, Ont.

The Bell Telephone Company of Canada have commenced operations on an extension to their telephone exchange on Dalhousie Street.

## Calgary, Alta.

It is stated that since the oil boom started some two months ago, more than six hundred new telephones have been installed in Calgary.

## Cupar, Sask.

Tenders are called to August 7th for furnishing material and constructing a telephone system for the Dalrymple Rural Telephone Company. Plans and specifications may be seen at the office of the Provincial Department of Telephones, Regina.

## Duncan, B.C.

The contract for supplying and installing the entire equipment required in the new city electric lighting plant was recently awarded to the W. Poole Dryer Company, Limited, electrical engineers of Vancouver, B.C., and Glasgow, Scotland. This installation will represent one of the latest developments in engineering practice in electric lighting plants as the dynamos are to be driven by Diesel engines burning crude oil of cheap quality. The equipment of the power station will consist of two Diesel engines each of 100 h.p. with 60 kilowatt alternating current generators and the necessary exciters mounted directly on the shaft of each generator. The contracting firm are having the Diesel engines, the Morley-Guldner type, made in Bradford, England, and are purchasing the electrical machinery, including the switchboard, from the Canadian Westinghouse Company. An interesting feature of the Duncan plant will be the unusually low cost at which it is claimed power can be generated, these engines consuming rather less than  $\frac{1}{2}$  lb. per B.h.p. of crude oil per hour. It is expected that the plant will be put into operation early in the Fall.

## Edmonton, Alta.

According to a local press report, an offer has been made to the city council of Edmonton by a firm of New York engineers to sell electric energy in Edmonton at a rate of 1 cent per kw.h. if the city will guarantee a consumption of 50,000,000 kw.h. per year. It is understood to be the intention of this firm to develop a water fall on the Moose River, a tributary of the Fraser beyond the Yellow Head Pass, and transmit at high pressure some 250 miles. When the minimum consumption mentioned above is exceeded a graded scale is offered which becomes  $\frac{1}{2}$  c per kw.h. When the yearly consumption reaches 100,000,000 kw.h.

## Estevan, Sask.

A contract has been awarded by the provincial government, Department of Telephones, for an exchange building to cost \$20,000.

## Hedley, B.C.

The Daly Reduction Company, of which the Hedley Gold Mining Company is a subsidiary concern, recently purchased from the Canadian Westinghouse Company a 1,250

kw.a., 3-phase, 60-cycle, 400 r.p.m., 6,600 volt, waterwheel driven generator complete with direct connected exciter, switchboard and electrolytic lightning arresters for both the mining company's generating station and the receiving end of the transmission line. The Morgan Smith Company got the order for an 1,800 h.p. waterwheel. A 440 h.p. synchronous motor which will be direct-connected to a compressor purchased from the Canadian Ingersoll-Rand Company, has been obtained from the Canadian General Electric Company who also supplied a 400 h.p. induction motor to drive a compressor which at present is driven by steam, as well as three 400 kw. self-cooled transformers. Greater power facilities for the mining operations of the Daly Reduction Company have been rendered imperative on account of the company's steadily increasing gold output, and the present steam and small hydro-electric plant will be supplemented by the installation of the recently acquired equipment at a point on the Similkameen River, necessitating the construction of a three-mile transmission line between the new hydro-electric development and the mill. January 1, 1915, has been named as the probable date for putting the new plant into commission. Mr. Gilbert McEachern is electrical superintendent of the Daly Reduction Company, and Mr. G. P. Jones, general manager.

## Kingston, Ont.

The local electric railway company which formerly ran their cars on Sunday have discontinued the service during the last two or three years. There is now an agitation among the citizens to have this service renewed.

## Lacombe, Alta.

The Waterous Engine Company, Brantford, have been awarded a contract for a boiler to be installed in the electric light plant.

## Lumsden, Sask.

The town of Lumsden has closed a contract with the Ferranti Electrical Company for a small alternator.

## Moosimin, Sask.

The Saskatchewan Government has awarded a contract to The Ferranti Electrical Company for two generators, and switchboard, for the government jail at this point.

## Montreal, Que.

It is announced that the power plant which was to have been erected on the Lachine Canal by the province of Quebec will not be proceeded with at present. Some preliminary development work has been undertaken.

The Canadian Westinghouse Company have secured an order from the Bathurst Lumber Company, Limited, Bathurst, N.B., for two 1,500 kw. turbo-generator sets, complete with jet condensers. Babcock and Wilcox boilers, with Foster super-heaters, will be installed. The equipment is required for a pulp mill which is being constructed.

Under an amended by-law, the Montreal Electrical Commission is given power to compel the removal of wires, overhead cables, poles, and transmission lines (with the exception of trolley wires) on the completion of the underground conduits or portion thereof. The Commission will also fix the rentals to be paid annually to the city for the use of the conduits.

The question of a new franchise for the Montreal Tramways Company has been again discussed. The civic Controllers have referred the subject to one of their num-



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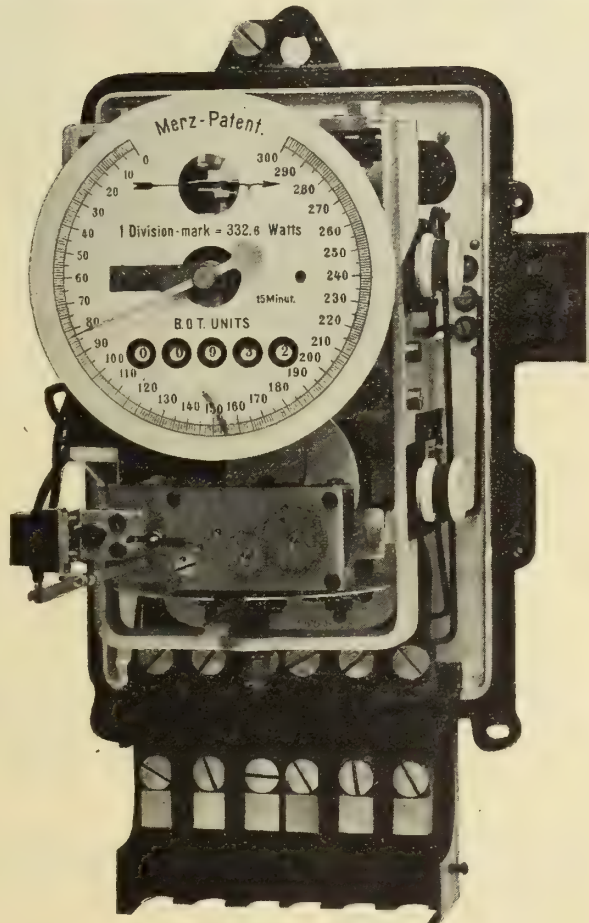
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1. Gives the kilowatt hours.
2. The highest load demanded in watts on a time average of say 15, 30 or 60 minutes.

The accurate measurement of these two quantities enables a true load factor system of charging to be adopted.



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ber for a report on the franchise and the provision of additional facilities. The Controllers are by no means agreed on plans to be adopted. Mr. Duncan Macdonald favors the preparation of a plan for subways and motor busses, while Mr. Herbert is against motor busses and advocates subways to be used in conjunction with the surface cars.

The Bell Telephone Company have either let contracts, or will shortly do so, for the following extensions: two-storey branch office, Bloor and Dufferin Streets, Toronto; two-storey building, North Toronto; extension of present office on Dalhousie Street, Brantford; three-storey building, Apple Street, Brockville; three-storey building, Cork Street, Guelph; branch office, Garfield Avenue, Hamilton; three-storey, King Street, St. Catharines; three-storey building, Sherbrooke.

Only two tenders were received by the Controllers of Montreal for the construction of underground conduits on St. James, Notre Dame and Craig Streets, and the intersecting streets between Craig and Notre Dame Streets from McGill Street to St. Lawrence Boulevard. The contract was awarded to Mr. G. M. Gest, who has secured all the other conduit work for the city, plans for which were drawn by the Electrical Service Commission. The sum of \$175,000 has been set aside for the latest contract, this including certain charges for engineering work.

The Eugene F. Phillips Electrical Works, Montreal, have obtained the following orders: 23 miles of cable for the city of Westmount, chiefly single and twin conductor of 7,500 volts, for use in connection with the new street lighting system of the city; 10 miles of 4400 volt three conductor cable for the Montreal Light, Heat and Power Company, to be used for conduit work; 10 miles of single conductor 4400 volt steel tape armored cable for the Hydro-Electric Power Commission of Ontario. Mr. Lawford Grant, manager of the Company, is on a trip to the Pacific Coast with a view to studying the business conditions. He will be away for about three weeks.

#### Outlook, Sask.

Tenders have been called by the Garden Valley Rural Telephone Company for the supply of material and construction of their telephone system.

#### Saskatoon, Sask.

A contract has been awarded by the city of Saskatoon covering one 600 kw. Peebles' La Cour motor-converter with auxiliary switch gear. This machine will operate in traction service in parallel with existing motor-generator sets. The motor-converter is comparatively new in Canada and was selected in this case as being superior to rotary-converter or motor-generators for the particular service required.

#### St. John, N.B.

The St. John Railway Company, through their solicitors, announce that they will extend their line of street railway through Glen Falls sub-division as far as Maynor House and that the work will be proceeded with immediately.

#### St. Thomas, Ont.

The City Council have decided to remove the arc lights at present used on Talbot Street and install nitrogen tungsten lamps. The cause of the change is partly on account of the decayed condition of the poles which at present support the wires and lamps. It is understood that these will be replaced by metal combination trolley and lighting poles from which the tungsten units will be suspended some sixteen feet from the ground. The arcs to be removed from this street will be concentrated in another section of the city where direct-current is available. In this way a much improved lighting service will be given throughout the city generally.

#### Toronto, Ont.

Plans have been approved by the Board of Control for a new car barn in connection with the Danforth Avenue section of the Toronto municipal electric railway system.

At a meeting of interested municipalities held recently, it was decided to inaugurate a vigorous educational campaign regarding hydro-radials throughout the Markham, Stouffville, Whitby, Port Perry and Uxbridge district. A schedule of lectures will be drawn up and every effort will be made to interest the electors and to give them all possible information preparatory to submitting by-laws in the near future.

Negotiations are proceeding between the Toronto & York Radial Company and the city of Toronto regarding the running of the Sunnyside cars over the new G. T. R. bridge. This would bring the suburban electric cars close to the point where the Toronto Railway system discharges its passengers at the western terminus of King and Queen Street lines, and would be a great convenience for passengers living in the western suburbs.

#### Vancouver, B.C.

The Canadian General Electric Company is delivering to Barr & Anderson, two 300 kv.a. 125/250 volt, three-wire generators which will be driven by Goldie & McCulloch cross-compound Corliss engines. This equipment will be installed in the new Vancouver store of the Hudson's Bay Company for which Barr & Anderson, Vancouver, have the contract for supplying the general mechanical equipment. It is expected that the plant will be operating about the middle of September.

That continuous advancement is being made in every part of the province is shown by the statement of development published monthly in Telephone Talk, the magazine issued by the B. C. Telephone Company. Thirty-nine telephone exchanges are operated and gains are recorded in nearly every instance, with very perceptible progress in the larger cities. Another article details extensions of outside plant which are in hand as well as additions to equipment in several of the offices. These are all on account of new business, indicating a live growth. One of the feature articles in Telephone Talk this month is descriptive of Grand Forks and district. This city is fortunately situated, having fine prairie-like far mlands in its immediate vicinity, and the illustrations show that it is up-to-date and progressive.

#### Victoria, B.C.

The new Royal Jubilee Hospital for which tenders were recently awarded covering the first unit of the construction, which comprises a brick power house and laundry buildings, will be equipped with an isolated electrical plant, designs of which have been prepared by Herbert C. Moss, of Seattle, Wash. As it is intended to proceed with only a section of the main building scheme at the present time, contracts will be taken for one 75 kw. and one 125 kw. turbo-generator set, provision being made for duplicating the two machines for future extensions. The plans and specifications of the electrical equipment include the installation of fixtures and lamps complete, designs of the fixtures being furnished. A special signal system will be installed to operate in conjunction with the clock system, and all calls will be recorded on a tape both at the time they are made and when answered. Electrically heated Gurneys are to be provided for conveying food from the kitchens to the different wards. The installation throughout will be thoroughly in keeping with the high standard of efficiency set by the architect, Mr. Loring P. Rixford, of Victoria. According to Mr. Moss, who has had considerable experience in designing the electrical equipment of large hospitals, the Royal Jubilee Hospital is the most convenient and best equipped building of its class he has ever worked upon. The total expenditure involved in the construction amounts to close on half a million dollars.



## TEN POINTS

1. The scale is uniform throughout the entire range of deflection.

2. The readings can be made with practically the same precision on violently fluctuating loads as on steady loads.

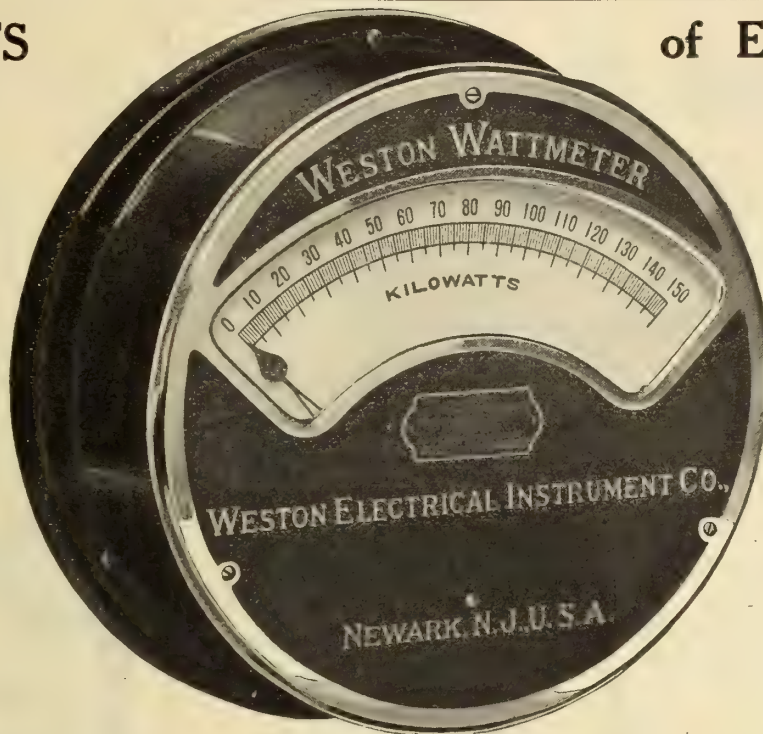
3. The indications are equally accurate on direct-current circuits or on alternating-current circuits of any frequency, power-factor or wave form within commercial limits. Therefore, these watt-meters can be calibrated with direct-current and used on alternating-current circuits without change of calibration.

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7. They have a large overload capacity, which will allow the measurement of full power at power-factors below 0.50.



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8. They are far more reliable and durable than any commercial wattmeter heretofore built.

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In the Weston Switchboard Wattmeter every heretofore existing difficulty has been satisfactorily overcome by intelligent design and skillful construction and the results attained with these instruments are far in advance of anything ever accomplished in the art of commercial electrical measurement. Send for catalogue giving full information regarding our complete line of A.C. Switchboard Indicating Instruments, Voltmeters, Ammeters, Wattmeters, Synchroscopes, Power Factor Meters, Frequency Meters, also D.C. Instruments.

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Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.  
 Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.  
 All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

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 150 h.p. Gas Engine, speed 275 r.p.m., manufactured by Bruce Macbeth, Cleveland.  
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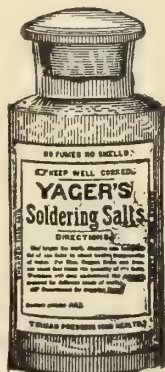
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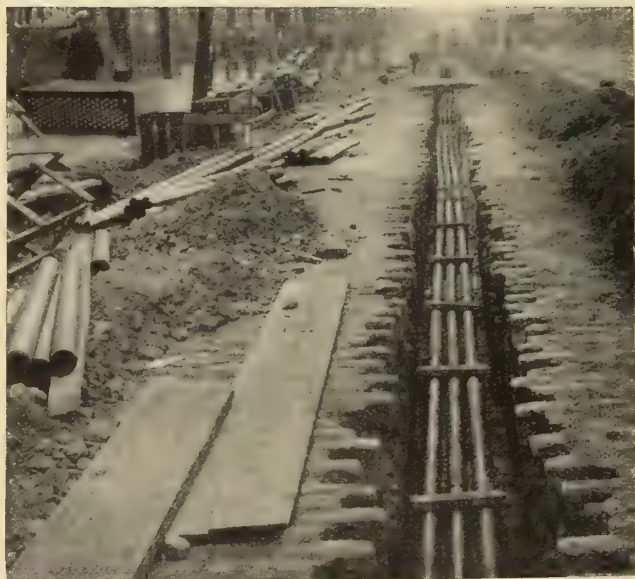
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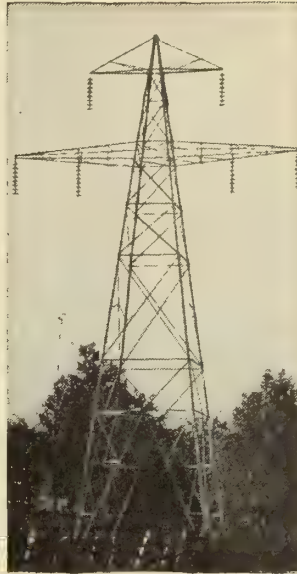
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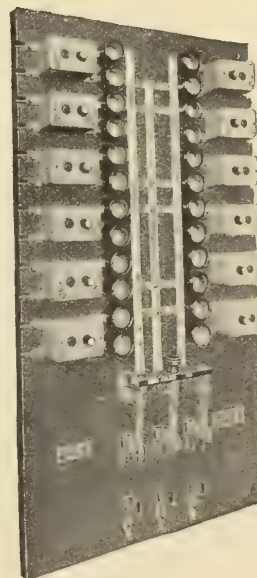
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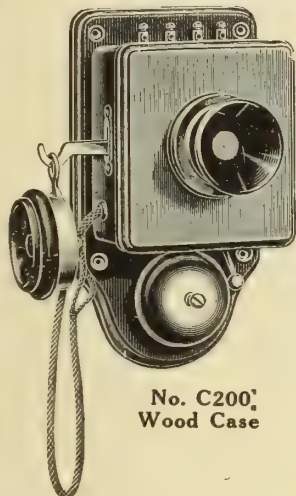
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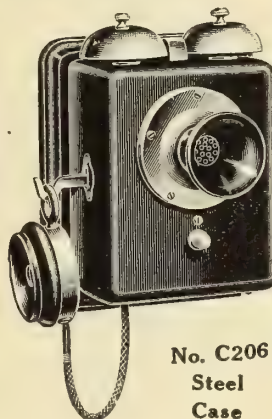
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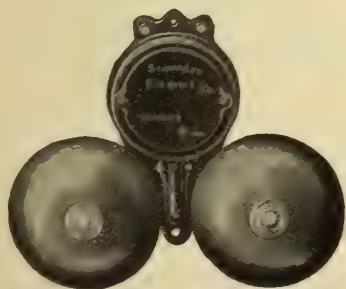
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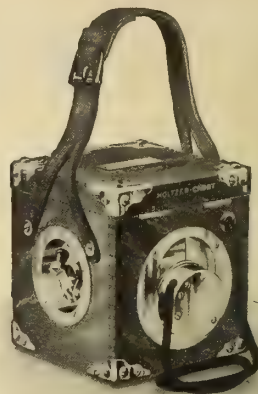
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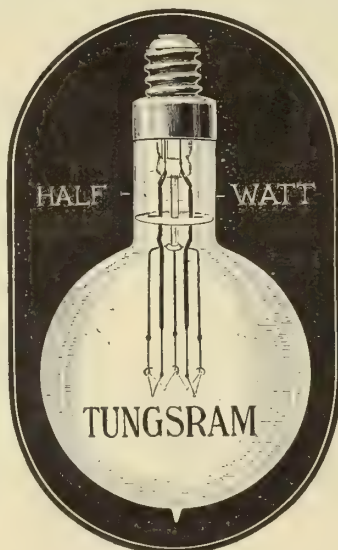
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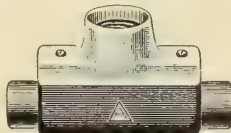
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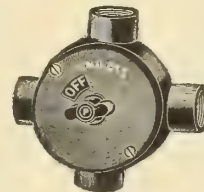
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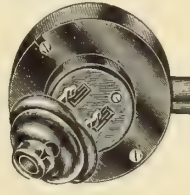
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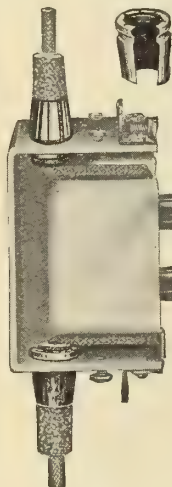
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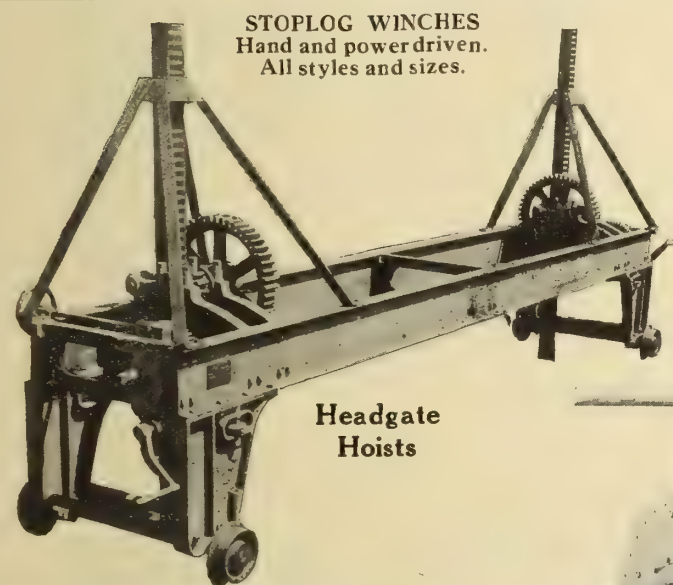
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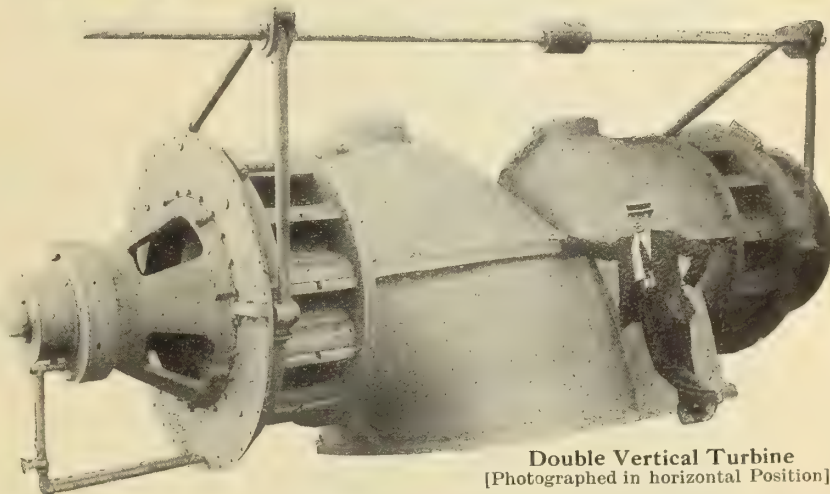
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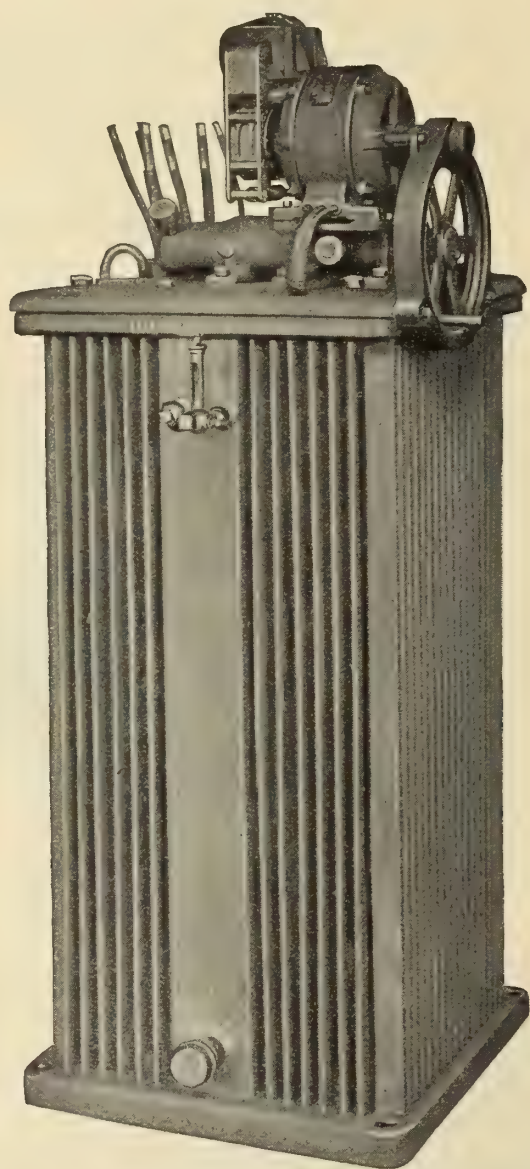
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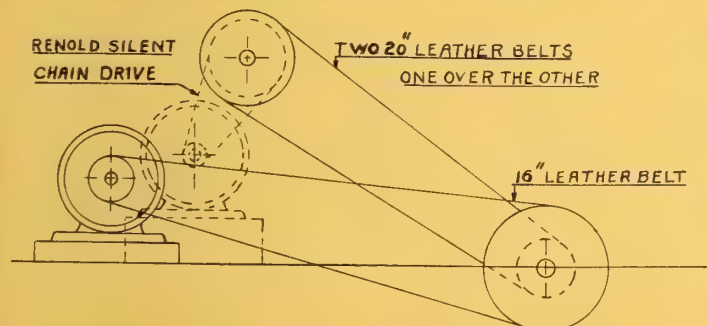
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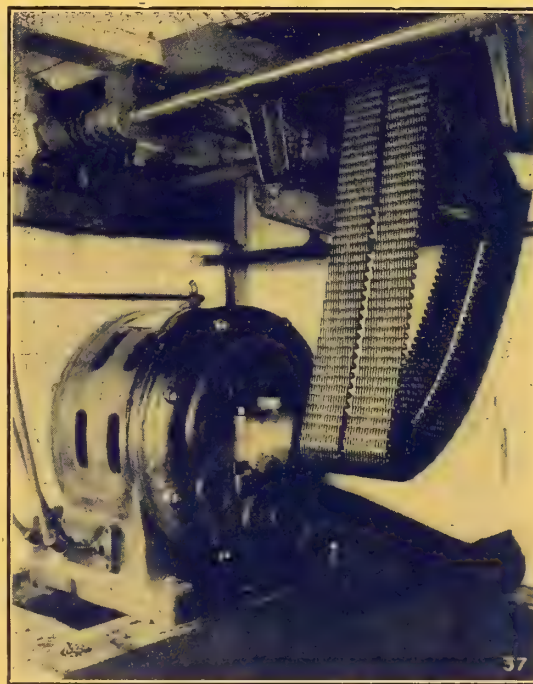


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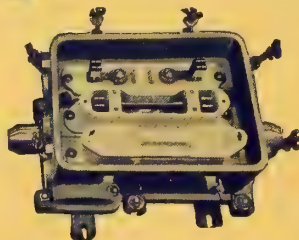
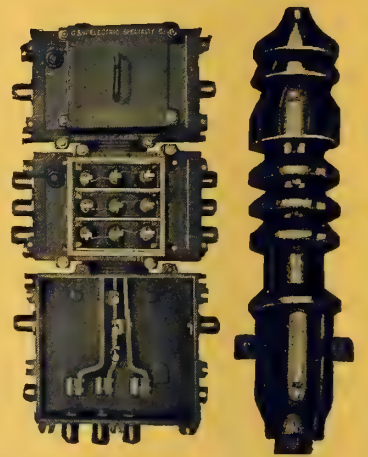
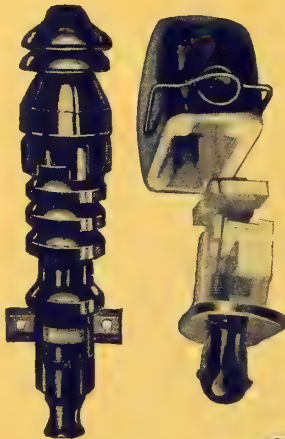
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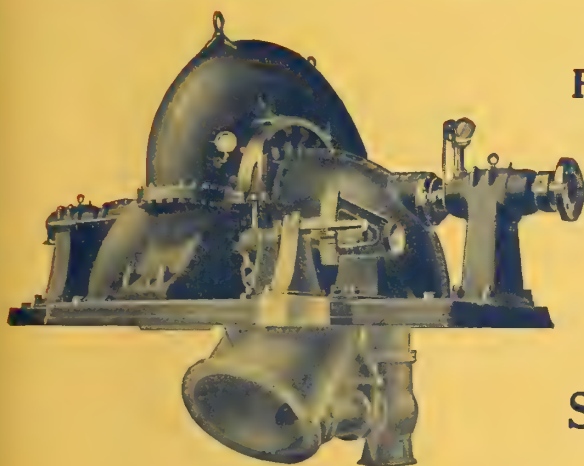
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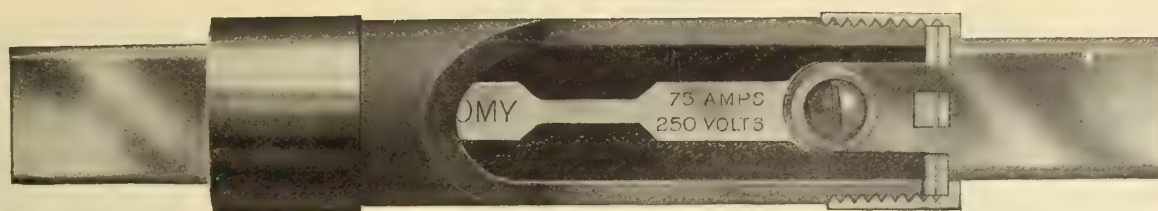
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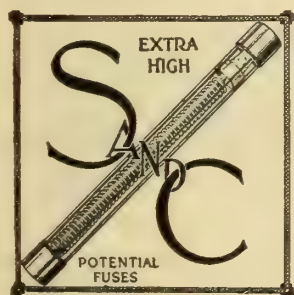


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St. Catharines and Winnipeg; St. John Railway Co., St. John, N. B.;  
General Supplies, Limited, Calgary, Alta.;  
Rudel-Belnap Machinery Co., Canadian Express Building, Montreal, Que.



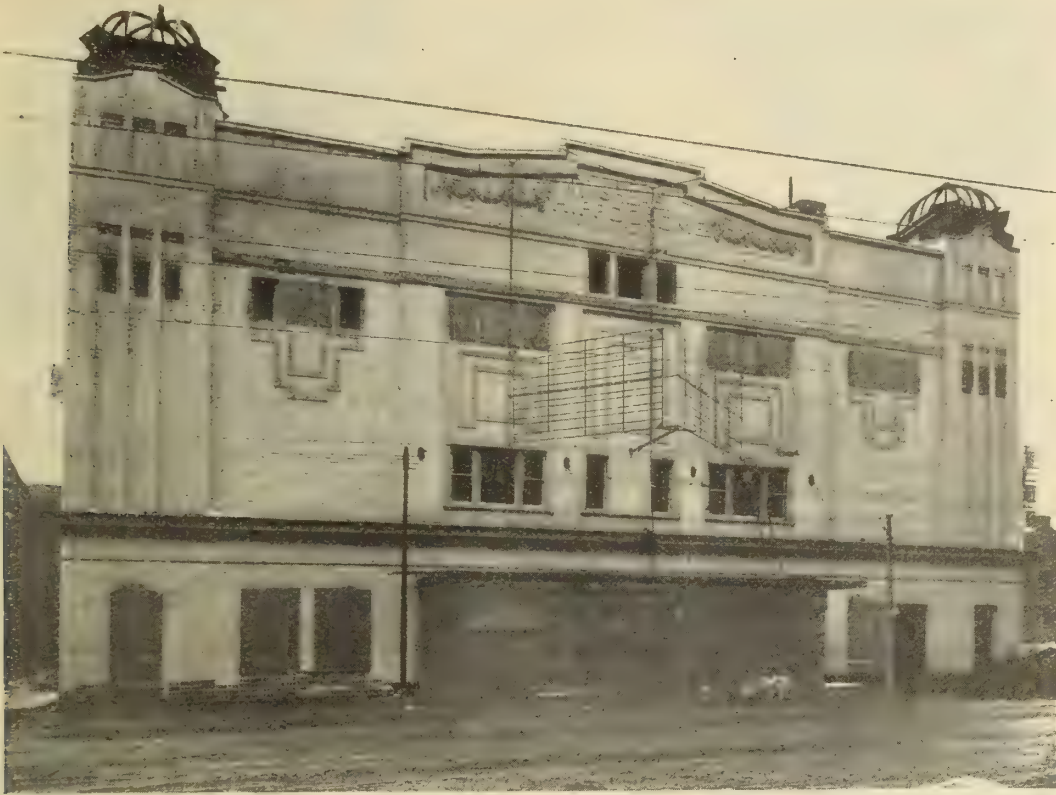
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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers



# **GALVADUCT**



Shea's Hippodrome, Toronto. A "GALVADUCT" Building.

L. K. Comstock,  
Electrical Contractor.

## **"GALVADUCT"**

The most perfect interior construction conduit on the market.  
Recognized as the standard of high quality.

Always specify "Galvaduct" or  
"Loricated" Conduits

## **"LORICATED"**

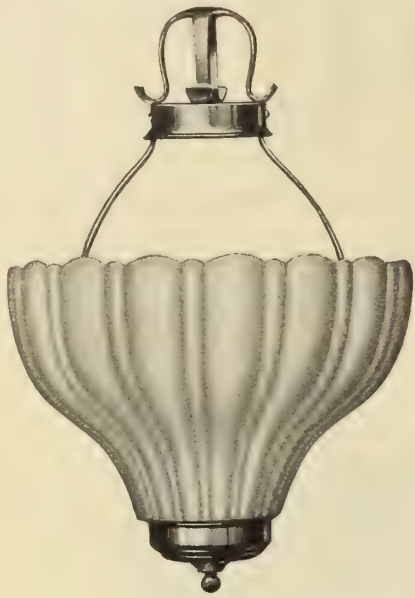
A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply  
you—write us

**Conduits Company Limited**  
Toronto - Montreal

# **LORICATED**





No. N004—60 Watt

## MOONSTONE High Lighting Efficiency

can be maintained at a minimum cost with the inexpensive Semi Indirect fitting here shown.

*Get our new Catalog and List.*

# JEFFERSON GLASS COMPANY LIMITED

Head Office & Works  
TORONTO

Branch Sales Offices

{ MONTREAL.  
WINNIPEG.  
VANCOUVER.

# SAFETY



# FIRST

FOR CONDUIT

## Xceladuct - Orpenite

Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by COPPER-PLATING and zinc coating.

Clean threads and smooth enamelled interior allows rapid fishing.

Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

Let us submit prices and particulars.

## Orpen Conduit Company, Limited

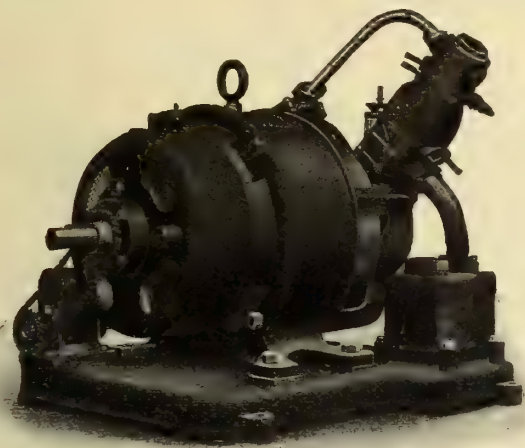
TORONTO, ONT.

MONTREAL, QUE.



## Economical and Reliable

for lighting direct or battery charging. Noted for simple design, low initial cost, low running expenses and ease of management.



## VSM Gasoline Sets

Made in various sizes, from 2 K.W. upwards, for standard voltages. They are neat and compact, occupy very little space, require little attention and give most excellent results.

**The Electric & Ordnance**

Head Office for Canada  
Lewis Bldg., 20 Bleury St., MONTRAL



**Accessories Co., Limited**

Works, Aston, Birmingham, England  
Mr. J. F. I. Thomas (Representative)

# Pole Line Hardware

That Stands the Test of Time and Weather

**WE MAKE ALL ARTICLES REQUIRED**

**WIRES: Copper---Galvanized for Electrical Construction Work, etc.**

**ALL STYLES OF: Bolts, Nuts, Rivets, Washers and Screws, Pole Steps, Guy Clamps, Cross Arm Braces.**

Send us your specifications to quote on.

:::

:::

Lowest Prices---Prompt Shipment

The **Steel Company of Canada, Limited**

Hamilton Montreal Toronto Winnipeg Vancouver Victoria St. John, N.B. Halifax



# Northern Light



## Your Customers Will be Interested

To Know That

### *Northern Light*

### MAZDA LAMPS

## Cut Down the Cost of Light Bills

Northern Light Mazda Lamps  
give 25% MORE LIGHT and  
consume 25% LESS CURRENT  
than Carbon Lamps.

## Your Sales on This Profitable Line Will be Increased

If you explain the fact to your trade.

The attractive cartons in which Northern Lights are packed will brighten up your shelves. They will prove automatic salesmen if prominently displayed in your store.

Northern Lights range in rating from 15 watts to 500 watts.

Large stocks are carried at all our houses. Your order will receive prompt attention.

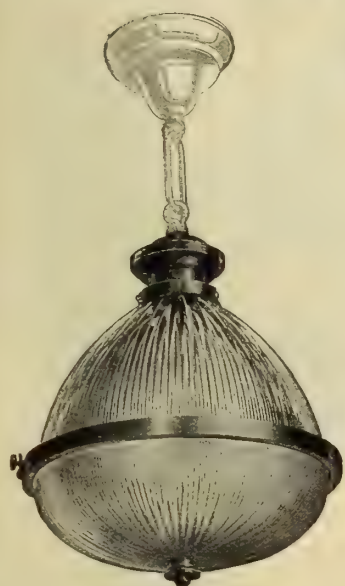
Address it to our nearest house.

*Northern Electric Company*  
LIMITED

Montreal	Halifax	Toronto	Winnipeg
Regina	Calgary	Edmonton	Vancouver
			Victoria



# There is Profit for You in Reflectors that Satisfy



STORE

## For Residences and Stores

We recommend the well known "Holophane" Reflectors. Their design combines practical use with artistic arrangement. They are especially adapted to Haberdashery or Departmental Stores where it is so necessary to have just the right distribution of light to show off fabrics to best advantage.

From the wide range of styles, many lighting combinations can be secured. Each is designed to meet a specific requirement.



STORE



RESIDENCE

## For Industrial Lighting

Benjamin Reflectors form an important factor in the lighting arrangements in many of the largest factories in Canada. Right in your territory you will find a profitable field among the various industrial concerns, the majority of which have poor artificial illumination. Make a list of these and see that these are systematically canvassed.



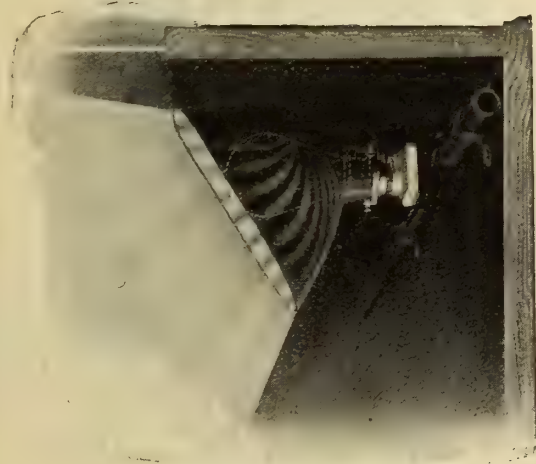
FACTORY

## For the Show Window

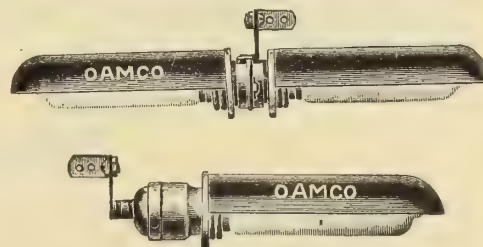
The value of many otherwise effective window trims is lost by improper methods of artificial illumination. Reflectors such as are here illustrated, are specially constructed to give the best results—hence our recommendation.



SHOP



SHOW WINDOW



SHOW CASE

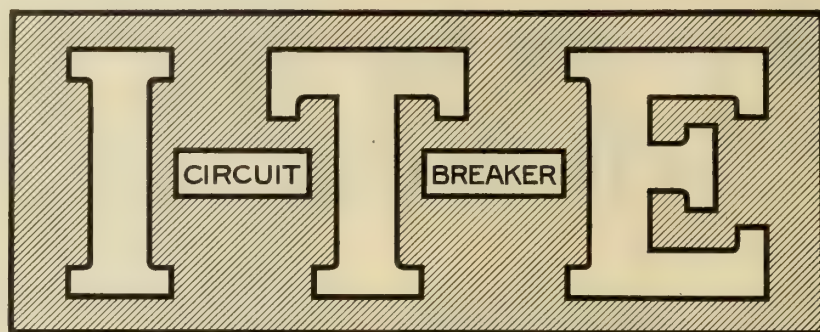
Montreal  
Halifax  
Toronto  
Winnipeg

**Northern Electric Company**  
LIMITED

Manufacturer of Telephone and Fire Alarm Apparatus and  
Distributor of Electrical Supplies for every possible need.

Regina  
Calgary  
Edmonton  
Vancouver





We did not originate the phrase

“Safety First”

Our slogan is

“Safety all the Time”

and an

I-T-E Circuit Breaker

provides it

The Cutter Company

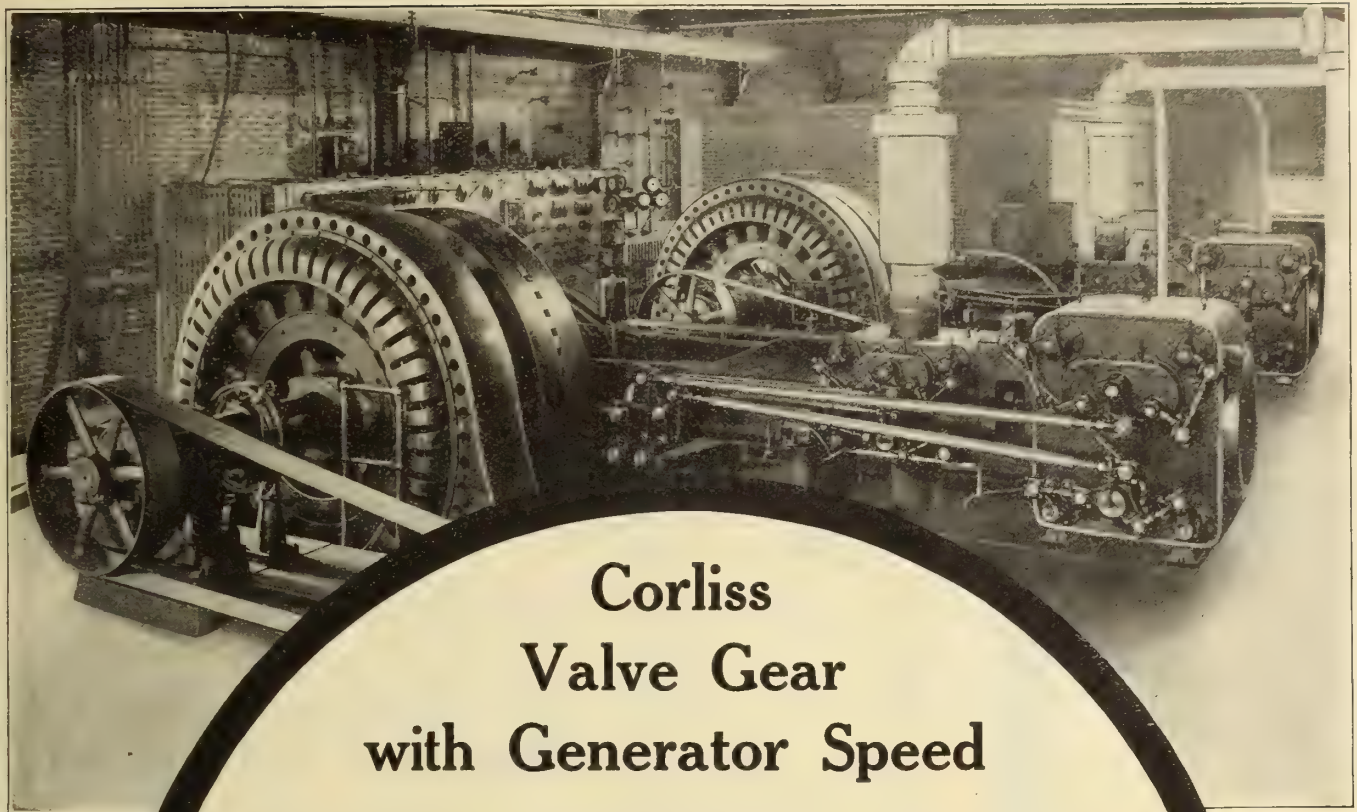
Circuit Breaker Engineers and Manufacturers

Philadelphia

The Cutter Co., 50 Church Street, New York City  
 The Cutter Co., Monadnock Block, Chicago, Ill.  
 The Cutter Co., Park Bldg., Pittsburgh, Pa.  
 The Cutter Co., Traders Bank Bldg., Toronto  
 The Cutter Co., Ford Bldg., Detroit, Mich.  
 The Cutter Co., Metropolitan Life Bldg., Minneapolis, Minn.  
 The Cutter Co., Woodward Bldg., Washington, D.C.

The Cutter Co., Telephone Bldg., Indianapolis, Ind.  
 Electric Mfrs. Sales Co., Denver, Colo.  
 Electric Mfrs. Sales Co., Salt Lake City, Utah.  
 Eccles & Smith Co., Los Angeles, Cal.  
 Eccles & Smith Co., San Francisco, Cal.  
 Eccles & Smith Co., Portland, Ore.  
 Frank Darling & Co., Vancouver, B.C.





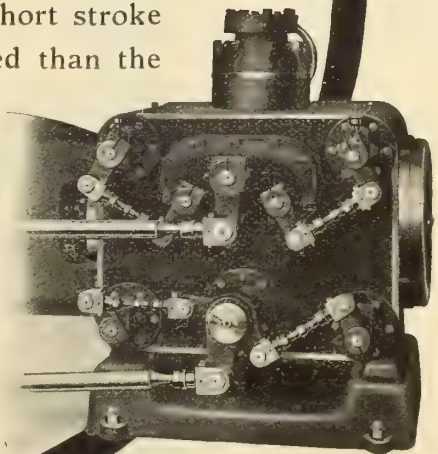
## Corliss Valve Gear with Generator Speed

This feature distinguishes

# Robb Corliss Engines

A simplified valve gear, multiported valves, short stroke and compact frame permit a much higher speed than the ordinary form of Corliss gear.

Half as many parts to wear, no springs, no dash pots, no latches, no cams, no disengaging parts, — but Corliss steam distribution and small clearances.



Scotch Boilers  
Vertical Engines  
Horizontal Boilers  
Water Tube Boilers

## INTERNATIONAL ENGINEERING WORKS, LIMITED

FRAMINGHAM, MASS.

AMHERST, N.S.

Montreal

Toronto

Winnipeg

Calgary

Edmonton

Vancouver



# Tallman Fixtures

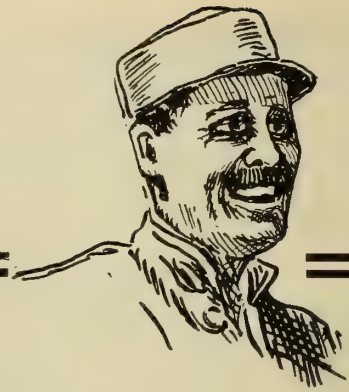
*They're different*



Bronze Standards

MANUFACTURED BY

**Tallman Brass & Metal Co.**  
HAMILTON, ONT.



## *The Engineer's Smile---*

when he tells you what he thinks of the McEwen in his engine room is more expressive than anything he can say—it fairly shouts "*More than satisfied.*"

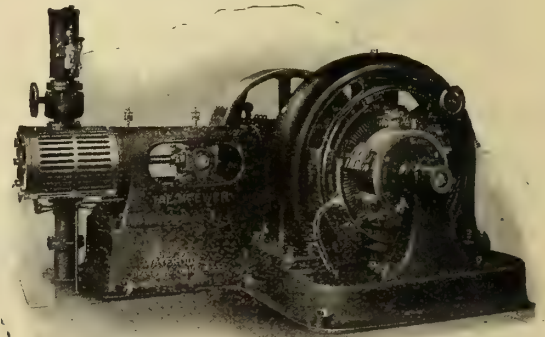
# McEWEN HIGH SPEED AUTOMATIC ENGINES

not only spell contentment from the operator's point of view but assure you of continuous satisfaction in the production of cheap electric light and power.

Economy in steam consumptions, a great range of power at command, and absolute reliability under all conditions make the McEWEN ideal for isolated plant use. Hundreds of users in Canada will vouch for this.

Built in simple and compound units up to 700 H.P. especially adapted for direct connection to dynamo.

Write for the McEwen Book.



THE  
WATEROUS ENGINE WORKS CO.  
LIMITED  
BRANTFORD, CANADA



# WAR EXTRA!

We offer for

## IMMEDIATE

Shipment from our Stocks  
in Montreal, Toronto, New York  
and Pittsburgh

Shelby Seamless Steel Boiler Tubes  
Shelby Seamless Steel Mechanical Tubes  
Shelby Seamless Steel Trolley Poles

Send us your Orders. We'll ship at once.  
New Stock Sheet just out. Use this Coupon.

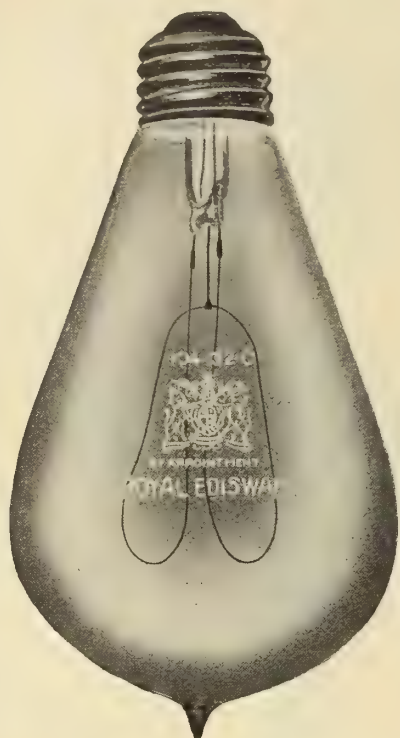
**John Millen & Son, Ltd.,** 321 St. James St.  
MONTREAL

Please send me your new Stock Sheet of Shelby Seamless Steel Tubes  
and Trolley Poles, and quote me for immediate shipment of .....

Name .....

Address .....





No. 21 Bulb, 50 C. P.

We are sole Canadian Agents for  
**“ROYAL EDISWAN”**  
**CARBON FILAMENT LAMPS**

In the manufacture of the “Royal Ediswan” Carbon Lamp, the makers have spared no effort to perfect a product of superior quality and maximum efficiency.

Those among your customers who prefer the carbon filament lamp will find in the “Royal Ediswan” a satisfaction which comes only from a high grade product.

Made in standard American bulbs, (also fancy bulbs) and built to standard specifications.

We are prepared to make prompt shipments on all orders—large or small.

**HALF WATT OSRAM DRAWN WIRE LAMP**

The Intrinsic Brilliancy of the filament is **Eight Times** that of the ordinary Tungsten Lamp.

This new lamp, as its name implies, consumes only **One Half Watt** of electrical energy per candle power.

Some advantages of the  $\frac{1}{2}$  Watt Osram Lamp :—High Efficiency, High Brilliancy of Filament, Long Life, Uniformity and Constancy of Light, Perfect Light Distribution, Great Mechanical Strength of Filament, Neat Appearance, No Loss of Candle Power due to discoloration.

*We can make immediate delivery from stock on 500 Watt type.*

**CHAPMAN & WALKER, LIMITED**

118-120 Richmond St. W., TORONTO, ONT.

VANCOUVER

MONTREAL

WINNIPEG—C. L. Trimmingham, 206 Nanton Building



# Special Prices

— ON —

## Electrical Books

### The Following Books are Offered Subject to Previous Sale

- The Steam Turbine, by Robert M. Neilson. Published in 1903 by Longmans, Green & Co., 294 pages, illustrated. Price \$1.00.
- Telegraphy, by Sir W. H. Preece, K.C.B., and Sir J. Sivewright, M.A. Published in 1905 by Longmans, Green & Co., 504 pages. Price \$1.00.
- Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company, 298 pages. Price 50c.
- Electrical Engineering, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price \$3.00.
- Radiation, Light & Illumination, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price \$2.50.
- Electric Motors, by Crocker & Arndt. Published in 1910 by D. Van Nostrand & Company. Price \$2.00.
- Short Course in Testing Machinery, by Morecroft and Hehrs. Published in 1911 by D. Van Nostrand & Company. Price \$1.
- Dynamo Electrical Machinery, by Sheldon & Hausman. Published in 1910 by D. Van Nostrand & Company. Price \$1.50.
- Electricity—Experimentally and Practically Applied, by Ashe. Published in 1910 by D. Van Nostrand & Co. Price \$1.00.
- The Dynamo (2 volumes), by Hawkins & Wallis. Published in 1909 by Whittaker & Company. Price \$4.00.
- Steam Turbines, by Kennedy. Published in 1910 by Whittaker & Company. Price \$1.00.
- Dynamo-Electric Machinery, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price \$1.00.
- Telephone Law, by A. H. McMillan. Published in 1908 by McGraw Hill Publishing Company. 332 pages. Price \$1.50.
- Practical Methods of Electro-Chemistry, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price \$1.00.
- Treatise on Thermodynamics, by Dr. Max. Planck. Published in 1903. 272 pages. Price \$1.00.
- Text-Book of Electrochemistry, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price \$1.00.

## Electrical News

220 King Street West

- Toronto, Ontario

# Use the Railway's Trolley Poles



Design No. 10015

as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of

## ERECO Combination Railway Lighting Pole Fixtures

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

## Electric Railway Equipment Co. Cincinnati, Ohio

Designers

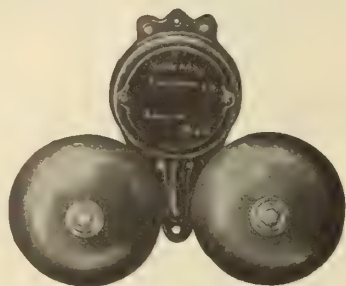
Manufacturers

Canadian Representatives:

Dawson &amp; Co., Limited, Montreal, Winnipeg

N. Y. Office, 30 Church St., Hudson Terminal Bldg.





## We Have a Bell For Every Purpose

There can be only one best and that is the Schwarze. No. 12 Common Magneto Extension for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire is all active. Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and very much louder, and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof.

Write for catalogue.

All resistances.

**Schwarze Electric Co., Adrian, Michigan**  
Norton Telephone Co., Canadian Agents

**John Starr, Son & Co.**

Limited

158 Granville St. - HALIFAX, N. S.

## Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,  
CONDUIT, MOULDING, SWITCHES, CUT-  
OUTS, FIXTURES, ETC., ETC.

Large Stocks - Prompt Shipments

Write Us for Low Prices

## Street Illumination

By Multiples and  
Series

**Pemco  
Fixtures**

**"The Practical Fixture"**

*Send for Bulletin No. 7*

**Philadelphia Electric and  
Mfg. Company**

PHILADELPHIA, PA.

Canadian Representative

A. H. Winter Joyner, Limited

76 Bay Street, Toronto

# Wm. Wurdack Electric Mfg. Co.

19 to 23 South Eleventh St., St. Louis, Missouri

*Manufacturers of*

## Switchboards — Panelboards — Cabinets, Etc.

We are in position to make up your special requirements at a low cost—Write us for prices before placing your next order.



# CASTINGS FOR ELECTRICAL WORK

We make Malleable Iron  
Grey Iron  
Aluminum  
Brass

## CASTINGS

Japanned or Galvanized

**GALT MALLEABLE IRON COMPANY, LIMITED**

Galt, Ontario

We specialize in this class of work.

### Here It Is RAPID TOAST-STOVE

TO RETAIL AT \$2.50



Can you beat it at the price?

Immediate Shipment. Standard Package 25.

Liberal Discounts.

Complete with Hubbell Attachment Plug.

**R. E. T. PRINGLE**

901 New Birks Bldg. 308 Tyrell Bldg. 150 Princess St.  
MONTREAL TORONTO WINNIPEG

### The Lachute Shuttle Co.

Lachute Mills, Que. Limited

*Manufacturers of*

**CROSS ARMS** made from straight grained Douglas Fir, Long Leaf Yellow Pine and Red or Norway Pine.

*The largest manufacturers of Cross Arms in the East.*

**INSULATOR TOP PINS** made from Birch, Elm, Locust and Oak.

**BRACKETS** made from Birch and Oak.

**POLE STEPS** made from Oak.

**STRAIN PINS** made from Second growth Hickory.

**SPECIAL PINS for HIGH VOLTAGE TRANSMISSION** made from Locust and Oak, all kinds and sizes.

All products boiled in Parafine and Stearine or Creosoted if wanted.

CORRESPONDENCE SOLICITED



Why not sell more day current?

#### Simplex Electric Household Ranges

make a strong appeal to the housewife for summer use. There must be many homes in your territory in which a Simplex Range could be sold, if its advantages were known. There is a size for every purpose, from the smallest kitchenette to the largest country house. You do yourself a good turn every time you recommend and sell a Simplex Range. It blazes the path for other Simplex goods and larger use of day current.

#### SIMPLEX ELECTRIC HEATING CO.

Mfrs. of Everything for Electric Heating and Cooking

BELLEVILLE, ONT.

CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.  
SAN FRANCISCO, 612 Howard St.

Member of THE RICE LEADERS OF THE WORLD ASSOCIATION

### DOSSERT CONNECTORS

besides increasing efficiency and safety, save time and labor on installation costs. Used for connections to panel boards, switchboards, busbars, switch and control gear, generator, converter and transformer apparatus, motors, and all shop wiring and apparatus

**DOSSERT & CO.,** 242 West 41st St., NEW YORK

H. B. LOGAN, PRESIDENT

IRVING SMITH. Canadian Rep., Unity Bldg., MONTREAL



## Flexible Tubing Clamps

Do away with nails, staples, tape and other make-shift methods of holding flexible tubing



Type A

These clamps prevent any displacement of the tubing after the job has been inspected.

**Type A**—For combination gas and electric outlets. The center opening for the gas pipe, the outside opening for tubing.

**Type B**—For straight electric outlets. For fastening directly to the Header Board or joist.

**Flexible Tubing Clamps** are quickly and easily installed, and should be back of the plaster line. They have round edges to prevent cutting the tubing when bent at an angle with the clamp.

Approved by the National Board of Fire Underwriters.

Write for prices and samples



Type B

**New Process Specialty Co., Inc.**  
Milwaukee - Wisconsin

## SWITCH BOXES



We manufacture the **Highest Grade Boxes on the Market.**

### **SERVICE**

We guarantee prompt shipment.

Standard sizes carried in stock.

Special sizes made up immediately.

**Our prices are right.**

**John T. Wilson, Limited**

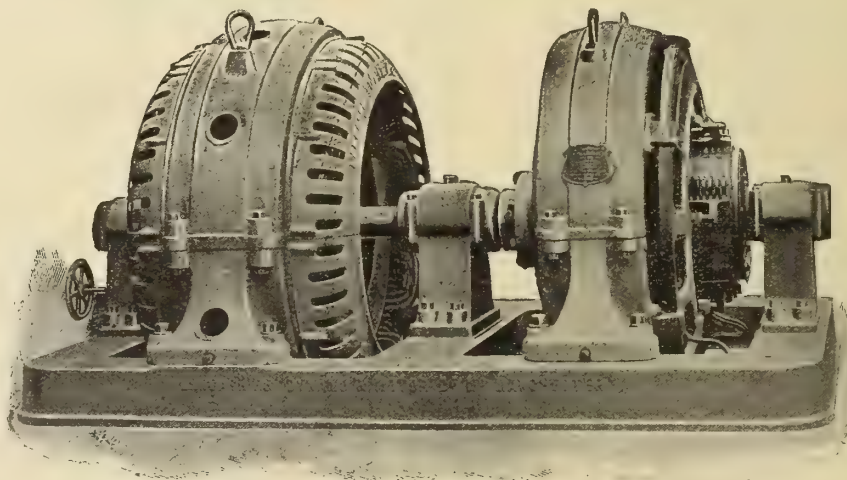
Toronto, Ontario

*Sales Representatives Wanted*

# Electric Motors for all Purposes

Curve Drawing Meters. Portable Type for Factory Use

The  
"Lancashire"  
Ball Bearing  
Induction  
Motor



The  
"Lancashire"  
Patent Reversing  
Drive for  
Metal Planers

Motor Generator—300 K.W. for Traction Service.

**The Lancashire Dynamo and Motor Co. of Canada, Ltd.**  
Montreal 107-109 Duke St., Toronto



**"HAVE YOU TRIED CANSTEEL?"**

Type A

Surface Boxes for Plug or  
Switch Cutouts—Entrance  
Motor Switches.

"Cansteel" Cutout, Panel and Switch-Boxes and Steel Cabinets are made in the BEST EQUIPPED SHOP IN CANADA which assures

**Highest Quality****Lowest Prices****Best Service**

Any style, finish or thickness. Now is the time to stock and order your wants.

**"WE ARE SPECIALISTS"****Canadian Steel Products Co.**

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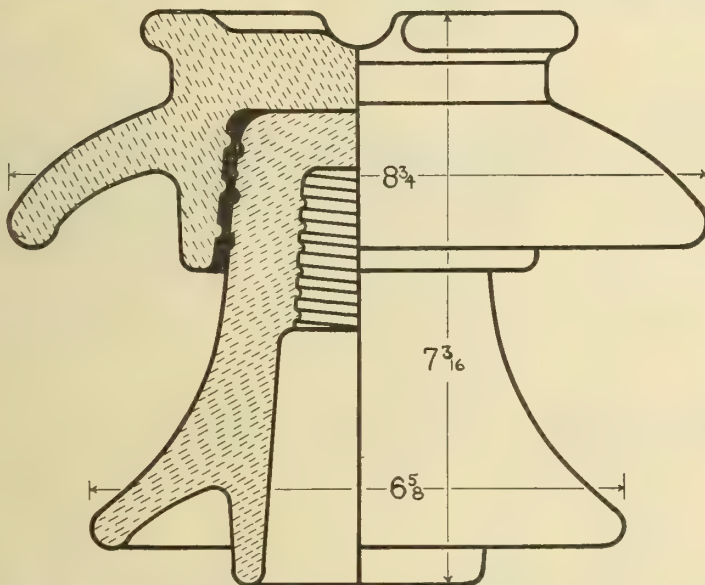
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**MONTREAL**

HAVE YOU OUR BULLETIN No. 1?

**CANADIAN INSULATORS**

Number	133
Line voltage	30,000
Test voltage	100,000
Rain test	65,000
Leakage distance	17 3/4-in.
Pin hole	1 3/8-in.
Net weight	10 1/2-lbs.
Packed weight	12-lbs.
No. per crate	6

**The Canadian Porcelain Company, Limited****HAMILTON, - CANADA****PORZELLANFABRIK HERMSDORF ( Germany ) S.---A.**

Works at: Hermsdorf (S.---A.) and Freiberg (Saxony)

Largest Porcelain Insulator Works  
1,500 Hands

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Known All Over the World  
36 Ovens

Specialties: High Tension Insulators, (Suspension Types) (Metal Covered Insulators)  
Insulators for Telegraphic and Telephonic purposes.  
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Representatives in Canada:

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## EXHIBITION

Call at our Showrooms, 22 College St., and see our line of Electrical Fixtures.

*SOMETHING NEW*

**CONDOR LAMPS**

ALWAYS IN STOCK

# C.H. Basters & Co.

**The GOOD Lamp**

22 College Street

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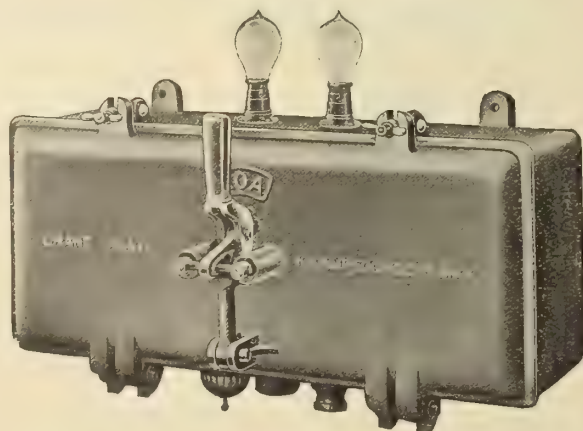
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TORONTO

## Light Weight, Small Size,

compact, and highly efficient. The main switch will give both a quick make and quick break, and is unaffected by vibration.

## VICKERS CRANE PANELS



consist of a D.P. main switch and fuses, branch fuses, plug and socket with switch and fuse for inspection lamp, and two pilot lamps.

Panels of 50 ampere size, for controlling a four motor crane, are only 10" high, 20" wide by 9" deep.

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Mr. J. F. I. THOMAS  
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## "UNION" SWITCH AND OUTLET BOXES

**They meet every need of the Contractor**

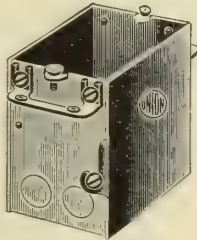


No. 103 Box

The "UNION" line of Outlet Boxes is complete; includes all the standard sizes and depths, with a full assortment of covers; adapted to accommodate the wiring devices of all manufacturers.

The "UNION" Sectional Switch Box is acknowledged to be the leader. Various depths and forms to meet every need.

"UNION" Boxes are for sale by all leading jobbers. Complete information in Box Catalog No. 27.



"DC" Box

**CHICAGO FUSE MFG. CO.**  
CHICAGO NEW YORK

## Bell Service that Boosts for you

When you show a man how to banish his Bell Troubles for all time, you win a life long customer. Recommend and install the

## Thordarson Bell-Ringing Transformer

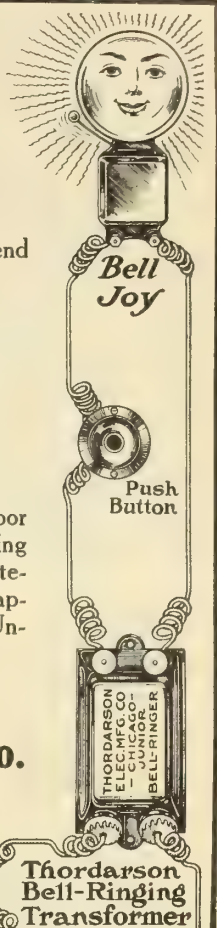
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Write for descriptions and discounts.

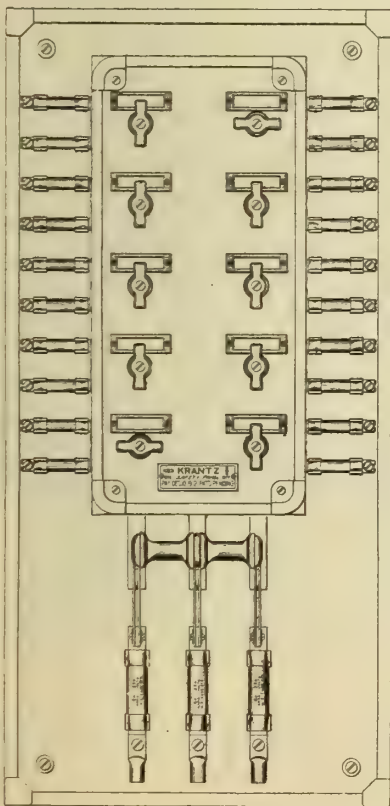
**Thordarson Elec. Mfg. Co.**

503 S. Jefferson St., Chicago

A. C. Lighting Mair



**Thordarson Bell-Ringing Transformer**



Krantz Safety Panel  
Without Trim

On the Largest Installations in  
Canada You Will Find the Name

# KRANTZ

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**Panelboards and Switchboards**

*We Manufacture*

Safety Panels, Metering Panels, Knife Switches, Switchboards of Standard and special designs.

The closest examination will convince you that our product is equalled by none although copied by many.

We are recognized leaders in switchboard and panel design and our engineers are at your service.

*Write for catalog No. 34, Jan., 1914.*

**The Canadian Krantz Electric and Mfg. Co., Limited**

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# Electrical Supplies Warehouse Space Adelaide St. W., Toronto

This new warehouse building is well suited for the displaying and stocking of electrical supplies.

It is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

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Centrally located at Adelaide and Charlotte Streets.

Light on four sides

Passenger and freight elevator  
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One block from four car lines  
Floor area, 6,300 sq. feet, each floor.

Ready for occupancy July 25th.

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Union Bank Building - Toronto

One of a hundred adaptations of the

## Campbell Automatic Time Switch

Switches any light, all lights, any time you wish.

Weather tight, gas tight, tamper tight —and you visit it once in 8 days.

*Send for Catalog  
Look it up.*

## Campbell Electric Co.

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Canadian Representative—Irwin Smith, 809 Unity Bldg., Montreal  
STOCKED BY PRINCIPAL JOBBERS





**CONNECTICUT**

## Electric Reset Annunciators

"Connecticut" quality—and twenty years of manufacturing experience—make this type "M" Electric Reset Annunciator a very popular style. It is made in several different styles and sizes and, like all Connecticut Annunciators,

## Possesses Many Advantages

Resets electrically—singly or in groups.	others, which means small current consumption.
One set of batteries for call and reset.	Reset button at bottom of case.
Occupies less space than other drops.	No permanent magnets to demagnetize.
Drop more sensitive than	

Write for Annunciator and Telephone Catalogs 22C. We are the largest manufacturers of interior telephones in the United States.

**Connecticut Telephone & Electric Company, Inc.**  
Meriden, Conn., U.S.A.

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Wire Rods  
Bare Copper Wire  
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For detailed information, samples, estimates or prices write our nearest office.

**STANDARD UNDERGROUND CABLE CO.  
OF CANADA, LIMITED**

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are drawn from steel and possess many merits which are an absolute necessity for up-to-date conduit work. For durability, neatness, space for making wire connections, "Unilets" meet all requirements. "UNILETS" are mechanically right. The conduit is steel, why not the fitting? Try them on your next job. A copy of our new catalogue should be before you. You cannot afford to be without it. Write us at once for your copy.



Cat. No. 9001—Rectangular Unilet.



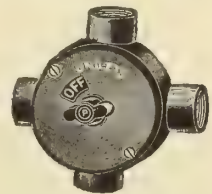
Cat. No. 9002—Rectangular Unilet.



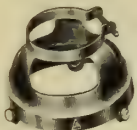
Type No. 2—Rectangular Unilet. Cat. No. 9002 with No. 7650 Receptacle.



Type No. 1 Octagon Unilet. Cat. No. 7501.



Type No. 4—Round Unilet with enclosed Snap Switch.



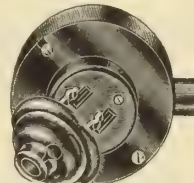
Cat. No. 7322—Shade Holder



Cat. No. 6906 Vapor-Proof Unilet.



Combination Plug Receptacle and Push Button Switch Unilet—Hubbell Plug Receptacle and Arrow E Push Button Switch Attached.



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**APPLETON ELECTRIC COMPANY**

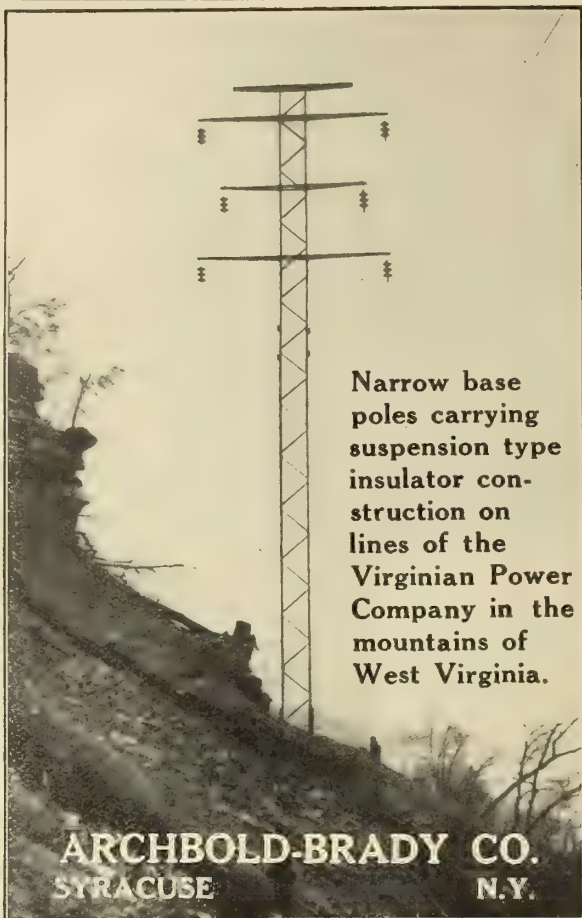
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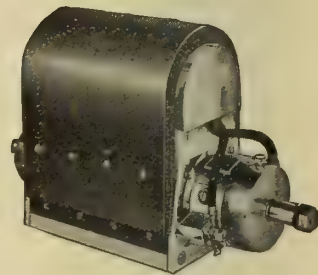
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## Speed Recorders Plotting Curves of R. P. M. Against Time



They indicate and plot a continuous curve of line shaft or machine tool speed. Attached to a hoist they record feet per minute—operated from a car axle, miles per hour. The curve shows every stop, time lost

and exact hour and minute of the idle period. This instrument is the most exact and reliable means of recording speed ever devised.



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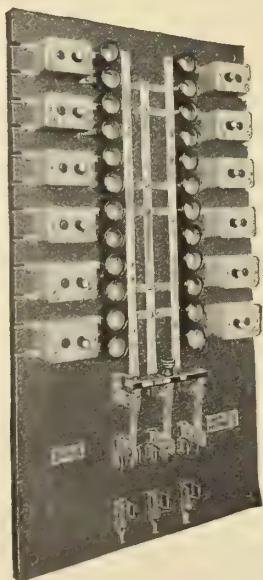
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Engineers and Manufacturers  
Indianapolis, Ind.

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with which  
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**Steel Cabinets**  
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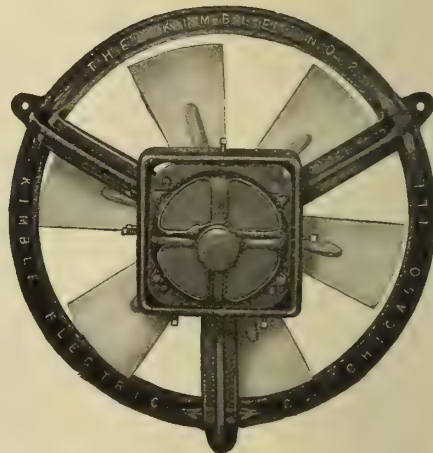
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30 to 5000 ampere

DO IT TODAY!  
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Reversible and Variable Speed



Single phase; 110-220 volts; 25-60 cycles; 18-36 blades; 100-800 revolutions. Can be operated at any intermediate speed by pulling a chain. Perfectly adaptable to all conditions.

Also made in polyphase constant speed types. For full particulars write

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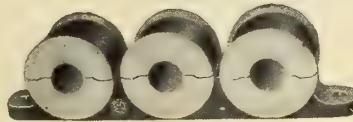


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Designers, Engineers and Manufacturers of

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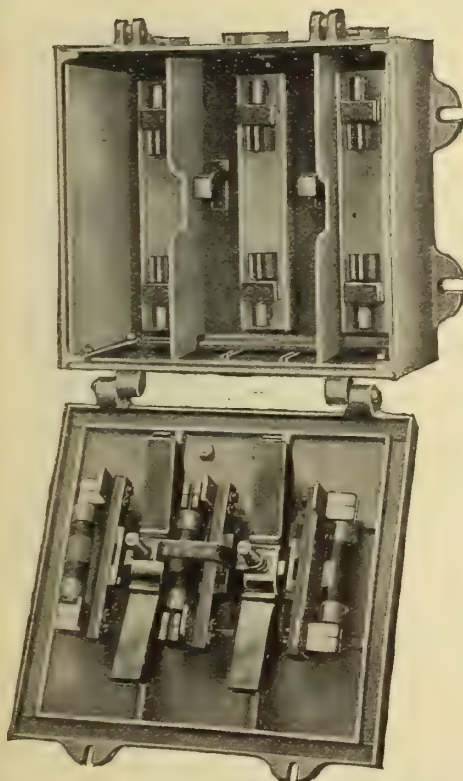


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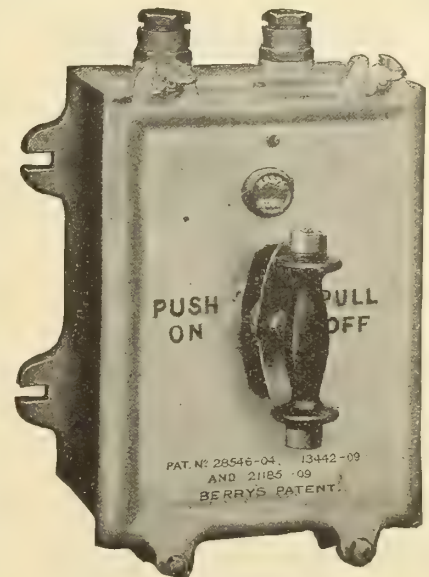
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Do not think only of loss by fire, but guard your employees against electrical accidents.

### BERRY'S PATENT

ironclad fuse-switch gear is used in every civilized part of the world, and is absolutely fool-proof.

Write for particulars to the sole agents in your territory:—



D. P. "Masta" Fused-Switch  
Weather-tight Type.

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T. P. "Masta" Patent Fused-Switch, with  
National Standard Code Fuses.

Berry, Skinner & Company, 78 Upper Thames Street, London, E. C., England

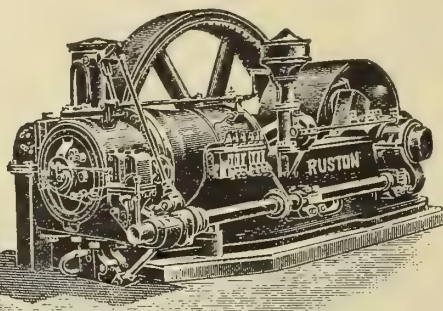
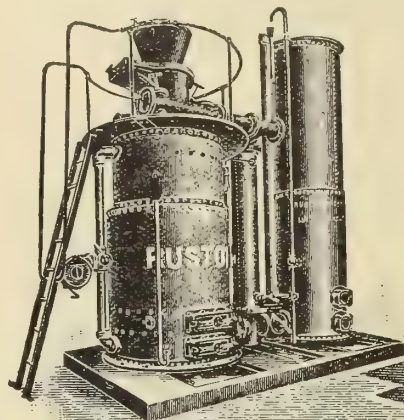


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Ruston Suction Gas Producer for Anthracite and Ruston Gas Engine.

## For Town Electric Lighting, Water Works or Sewage Disposal

For Economy, Reliability, Ease of  
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# Ruston

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For Anthracite, Coke and Charcoal

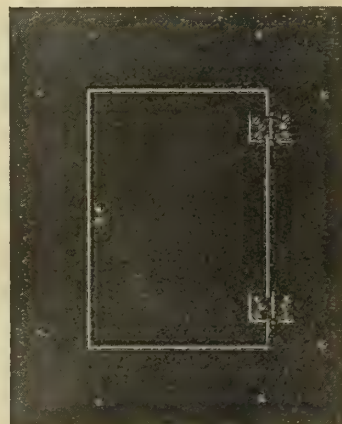
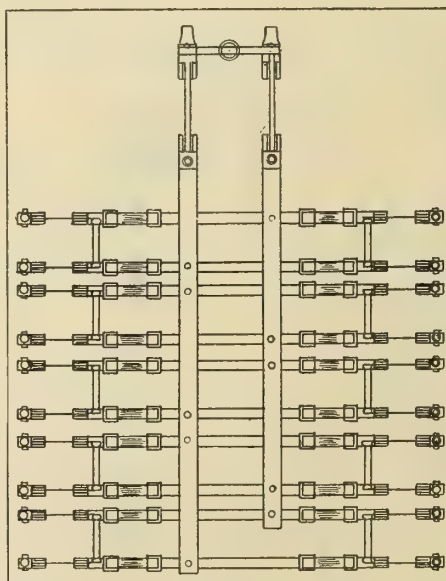
Patent Producers for using all kinds of Wood  
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## PANELS

Devoe Panels are manufactured to meet every underwriter requirement. They are exception-  
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*The Willard Storage Batteries.*



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It contains over 600 pages of valuable data and listing of

**Hi-Tension Insulators  
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## A Technical Advantage

The E. A. C. High Torque Single Phase Meter absorbs only 1.4 watts in its shunt system. This is equivalent to 12.5 units per annum.

If you will compare this loss with the shunt loss of several other meters on the market, you will easily realize that there is a good reason why it will pay you to use E. A. C. Meters. E. A. C. Meters have been approved for verification by the Canadian Inland Revenue Department.



For the next Technical Advantage  
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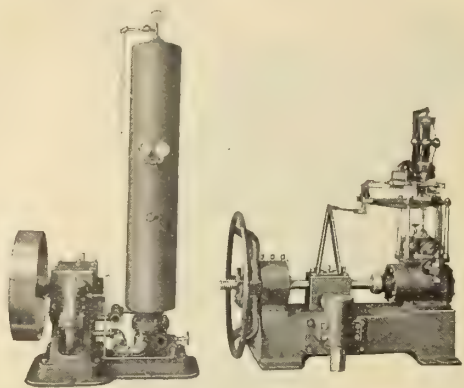
# The Electrical Apparatus Co., Limited

—Vauxhall Works—

South Lambeth Rd., London S. W., England

Telegraphic Address—Elapratu, London. ABC Code 5th Edition.





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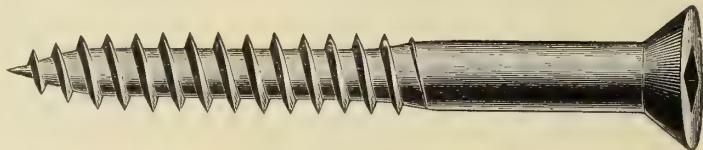
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**THE LOMBARD GOVERNOR CO.**

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PAT. FEB. 2, 1909

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They are used by simply placing the screw on the driver and then you may reach out at arm's length and drive it in with one hand. For overhead work or work between joists or under flooring it is invaluable.

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Portable and Laboratory  
Loads

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Type B shown in  
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Send for bulletin 19

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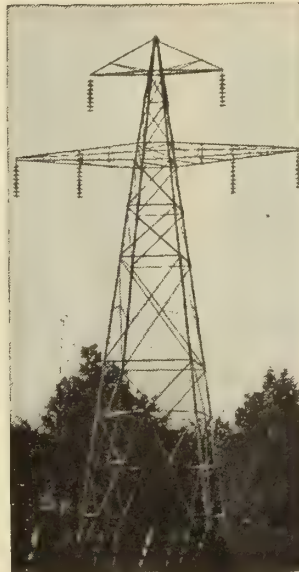
That is what you want your Rail Bonds to do. There are several kinds of bonds that will do it. There is **one** kind that not only will hold on, but absolutely will not corrode at the terminals.

Electric Welded bond terminals are guaranteed.

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## TRANSMISSION TOWERS



Hot Galvanized or Painted

Estimates furnished on application

### The Canadian Bridge Co.

Limited

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STEEL RAILWAY AND  
HIGHWAY BRIDGES

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One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario. Transmitting a 110,000 volt current from NIAGARA FALLS to the principal cities of ONTARIO. The largest single order of Transmission Towers ever placed.

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Fixture Parts—Chain—Loops—Pans—Castings, etc., carried in stock at all times for immediate shipment.

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ELECTRIC  
FIXTURES  
STANDS FOR  
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DROP A CARD  
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WILL CALL,  
GLADLY.

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Enclosed Fuses

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**CHASE-SHAWMUT CO.**  
Newburyport, Massachusetts

**FRANK G. SCOFIELD**

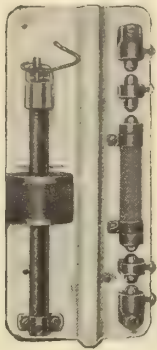
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702 LUMSDEN BLDG.

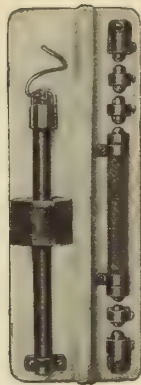
TORONTO, ONT.



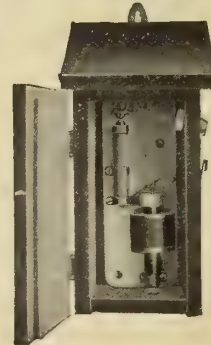
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Arresters for A. C. Service 1200 to 2500 volts.



Arresters for A. C. Service 2500 to 3500 volts.



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## To Get Complete Protection

Only Garton-Daniels Lightning Arresters can offer you "complete" protection. Their small air gap distance, low series resistance and positive mechanical circuit breaker insure efficient protection, eliminate low voltages, winking lights, etc., and make grounds and short-circuits through the arrester next to impossible.

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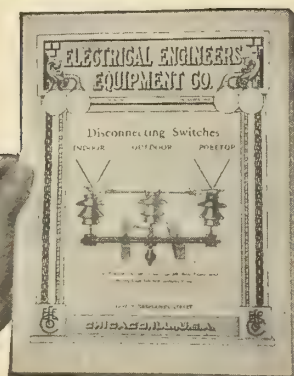
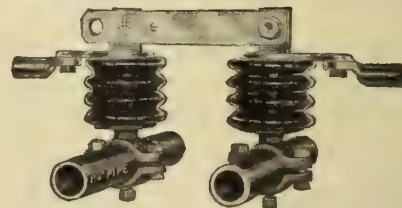
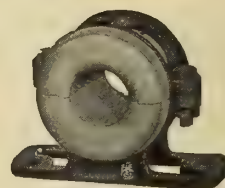
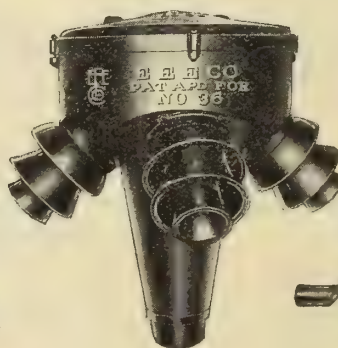
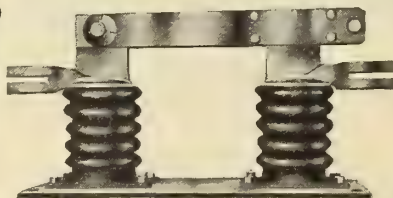
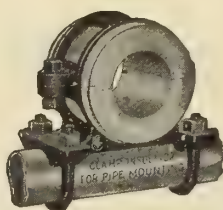
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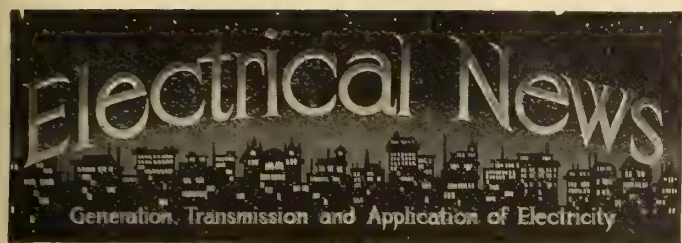
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No. 16

## Canadian Water Powers

In connection with the International Engineering Congress which is being held at San Francisco next September during the Panama-Pacific Exposition and under the auspices of the four National Engineering Associations of the United States, arrangements have been made by the Dominion Government to have the tremendous water power resources of Canada properly presented.

Preparations for a Water Power Exhibit in the Canadian Building at the Exposition have been under way for several months, and it is understood that this will take the form of a large landscape painting of Canada, about 70 ft. long by 9 ft. high, arranged in a semicircle, in front of which there will be working models of typical water power plants from the Atlantic to the Pacific. This painting will be the largest of the Dominion of Canada ever attempted, and is being executed by Mr. Gibson Catlett, landscape artist, of Toronto. The models themselves, some 14 in number, are being constructed by engineers in Toronto under the direct supervision of the Superintendent of the Dominion Water Power Branch, Mr. J. B. Challies. In addition to this water power exhibit, the Dominion Government has arranged to have papers prepared and read at the Congress by eminent Canadian engineers. These papers, and the discussion arising therefrom, will give the Congress some conception of the water power situation in Canada.

This Congress will offer an excellent opportunity for having Canada's immense water power resources, and the tremendous strides that have already been accomplished in development of these water powers, placed before the eminent engineers who will attend from all over the world. Every effort will be made to have as many of these engi-

neers as possible return home to their own countries through Canada, in order that they may visit the well-known power developments throughout the country, and at the same time secure an accurate knowledge of the great industrial and commercial development, which is so dependent on cheap hydro-electric power. Enormous benefit has already been realized by this country from the visit of the foreign geologists to Canada last year. Probably no better investment has been made by the government than the financial grant for the entertainment and cross-country tour that these geologists made, under the direction of the Director of the Geological Survey of Canada. Hundreds of thousands of dollars of foreign capital has since been invested in this country in mining operations as a direct result of advice given foreign capitalists by these geologists, who were given every opportunity of seeing for themselves the great mineral wealth of the country awaiting capital for development. As cheap hydro-electric power is the keynote to the future industrial development of this country, every effort should be made by the government to have all water powers of economic importance thoroughly investigated by competent engineers, and developed wherever there is any reasonable demand for power.

We have been given to understand that the large railway corporations and the operating power companies throughout the country are co-operating with and rendering every possible assistance to the movement for having Canada's water power resources advertised in the best possible manner at the Panama-Pacific Exposition.

## Our Electrical Exhibition

Manufacturers and dealers in electrical equipment will doubtless, as in the past, this year spend very considerable sums of money in displaying their products before the million, and more, people that will attend the Canadian National Exhibition. There is no doubt that this display is good business, as the people who attend the exhibition go there with a desire to see the advances that have been made during the past year. It follows that the impressions they get of any particular industry regulate, largely, their conversation and their purchases during the following twelve months.

The electrical display at Toronto's yearly exhibition has during later years been most excellent and of a highly attractive and educative nature. As we have said before, however, and as the average visitor is constantly saying, the scattered arrangement of the electrical exhibits makes it practically impossible to form either a comprehensive or a relative opinion on the various classes of equipment shown. A separate building to be known as the Electrical Building is as important as a separate building for art, or stoves, or manufacturing, or sheep, or hogs. Even more so, because the electrical idea is a comparatively new one. Its magnitude is not appreciated nor the practical value of the thousand and one devices which are now on the market. For this reason, again, it is all the more necessary to emphasize the importance of the electrical industry by having it all in one building so as to make as good a showing as possible.

There is probably no more aggravating experience, either, than that of the technical electrical visitor who attends the exhibition chiefly to see the electrical display. He trots about from one building to another in a vain effort to see all the exhibits; losing time and patience before he locates some of the most interesting equipment in some of the most obscure corners and in the most incomprehensible surroundings. The writer remembers, in the recent past, an electrical exhibit among the fancy work and still another among the vegetables. This may be good enough strategy from the point of view of that particular dealer but it is not so from



the point of view of the electrical industry as a whole, the magnitude and importance of which it should be the chief aim of the exhibitors to demonstrate.

Possibly, manufacturers and dealers do not sufficiently appreciate that this is the best opportunity of the whole year to show the purchasing public what they have to sell and why they should buy it. On the other hand, it is more than possible the exhibition management do not appreciate the value of our industry or the fact that they are losing many valuable exhibits through lack of proper accommodation. It is sincerely to be hoped that something may be done even yet this year to remedy one of the most apparent defects in our truly wonderful national annual display.

### Conservation in Quebec

The Quebec Streams Commission have just issued, in two volumes, the English translation of their second report covering the work of the year ending November 30, 1913. The report covers much work looking to the general study of water power conditions and storage of water powers for industrial developments, but it also deals especially with the proposed water storage on the St. Maurice River. The Quebec government will erect a large storage dam some 240 miles from the mouth of the St. Maurice and at a point just above the La Loutre Falls. Plans of the dam are reproduced in the report which also include plans for a small water power development to be used to operate the control gates.

The necessity for storage on this river is shown by the great variation of readings taken at different points at different seasons of the year. For example at Shawinigan, a minimum of approximately 6,000 second feet has been observed as against the maximum of approximately 170,000 second feet, so that the proportion of flood to low water is almost 30 to 1. Higher up the river the variation is not so great, due to the fact that the large lakes act as natural

reservoirs. The following figures give an estimate of the different falls on the St. Maurice with data in connection with each, the capacity under the present conditions, the capacity under regulation conditions, etc. It is understood that the figures representing the present developed capacity of the plants do not include two 37,000 h.p. units since installed at Shawinigan and some 50,000 h.p. in turbine units being put in at Grand Mere by the Laurentide Pulp Company.

The Quebec Streams Commission is composed as follows:—S. N. Parent, chairman, Ernest Belanger, C.E., and W. I. Bishop, C.E.; H. L. DeMartigny is secretary; Olivier Lefebvre, C.E., chief engineer. A number of prominent engineers have been connected with the work including J. W. Thurso, C.E., Edward Wegmann, James M. McCarthy and Arthur St. Laurent.

### Two Interesting Reports

Two valuable reports were presented by Mr. Magalhaes and Mr. MacLachlan respectively at the recent annual meeting of the Canadian Electrical Association. These reports are referred to in extract on other pages of this issue. Mr. Magalhaes' report dealt with the work of the Meter Committee of the N. E. L. A. Mr. Magalhaes pointed out the three general sub-divisions of the year's work and placed particular emphasis on the spirit of co-operation that existed between the regulation commissions and the N. E. L. A. association, as also between the manufacturers and the association. It was pointed out that this co-operation was a mutual benefit to all the parties concerned and should obtain to the same extent in Canada. Mr. Magalhaes also drew attention to the practical manner in which the several committees developed the reports they were required to present. A report differs from a paper in that it is the unanimous consensus of opinion of several men each of whom represents a commercial organization having daily experience of

STATEMENT OF THE WATER-POWERS ON THE ST. MAURICE RIVER

NAMES	Distance from St. Lawrence, (miles.)	Head in feet.	Approximate area of drainage basin above (sq. miles.)	Actual minimum flow, 0.37 cu. ft. per sec. per sq. mile.	Present value 80% efficiency.	Regulated minimum flow of 12,000 c.f.s. at Shawinigan.	Value after regulation.	Increase in value through regulation	Power installed.	Increased primary power which will be used.	Increased power left unused.	Increased water-power yet unsold.	Present owner.
	Miles	Ft.	Sq. M.	c. f. sec	HP.	c. f. sec	HP.	HP.	HP.	HP.	HP.	HP.	
La Gabelle.....	13	10	16550	6123	5556	19123	11010	5454	.....	.....	5454	.....	Grès Falls.
Les Grès.....	15.5	40	16500	6105	22200	12105	44018	21818	.....	.....	21818	.....	" "
Shawinigan.....	21	150	16200	6000	81818	12000	163636	81818	183300	81818	.....	.....	Shawinigan W & P Co.
Grand'Mère.....	33	75	15860	5870	40022	11870	80931	40909	19500	40909	.....	.....	Laurentide Co.
La Tuque.....	103	80	12000	4440	32291	10440	75927	43636	3500	.....	43636	.....	Q. & St. Maurice Industrial Co.
Sans Nom.....	110	128	10030	3711	4318	9711	11300	6982	.....	.....	.....	6982	Crown.
Vermillon.....	119	16	10020	3707	6066	9707	15884	9818	.....	.....	.....	9818	"
Blancs.....	138	136	8115	3002	37115	9002	111296	74181	.....	.....	.....	74181	"
Grands-Cœurs.....	171	90	6425	2377	19448	8377	68539	49091	.....	.....	.....	49091	"
La Grâce.....	183	33	6325	2340	7020	8340	25020	18000	.....	.....	.....	18000	"
De L'Ile.....	191	44	6225	2303	9212	8303	33212	24000	.....	.....	.....	24000	"
									206300	122727	70908	182072	



the matters under discussion. Until each point has been definitely settled it is not allowed to appear in the report.

Mr. MacLachlan outlined the work of the street lighting committee of the N. E. L. A. and pointed out a number of advantages that were accruing to the Canadian Electrical Association from the affiliation. Mr. MacLachlan mentioned the quantity of data, for example, in connection with modern illumination, that had been collected by the N. E. L. A. and emphasized the value that such information must be to every Canadian company. The work of the street lighting committee for the past year is outlined in considerable detail.

### The Aluminium Arrester

We print elsewhere in this issue a paper presented by Mr. E. E. F. Creighton before the A. I. E. E. on "The Present Status of Aluminum-cell Lightning Arresters," with the discussion which followed. The subject is treated in a general way and an effort made to answer the oft-repeated question as to whether aluminum lightning arresters are actually performing the service that is claimed for them, why they appear to be efficient in certain cases and not in others and whether they are likely to be superceded by other types. The answer given by Mr. Creighton and borne out by the speakers which followed demonstrates pretty clearly that the aluminum arrester is an exceedingly valuable equipment not likely to be superceded but, on the contrary, almost certain to come into general use, with the better understanding of the requirements of transmission lines and the corresponding changes and improvements in the arrester. The point brought out most forcibly in the paper is that we do not yet understand the nature of a lightning flash. Indeed, it is impossible to anticipate the effect of any lightning flash in as much as the characteristics of different flashes vary widely. Much also depends upon the point at which the lightning strikes the line. These facts account for the apparent failures of aluminum arresters to protect the line under certain conditions. It is not, Mr. Creighton points out, that these arresters cannot be made to meet any particular conditions that may arise, but that, to date, they have not been able to be constructed so as to meet all the conditions. Dr. Steinmetz contributed some important information regarding the form of the wave front of a lightning surge and pointed out that the form of this wave when it reaches the arrester will vary very greatly with the distance it has travelled and the resistance it has met with.

### Underground Work in Toronto

A quantity of underground work in connection with the municipal electric distribution system is at present under construction in Toronto. This consists of building a 15-duct run on the south side of King Street from John Street to Jarvis Street. Single 3-in. clay ducts are laid three wide and five high the top layer being square bore distributor duct. Several difficult channels have had to be made under car tracks, namely at York Street, Bay Street, Yonge Street, and Church Street. A single fibre duct of 3-in. diameter is used to connect run to all service boxes in the old run in the sidewalk. The ducts are encased in three inches of concrete and are laid with a minimum cover of 30 ins. from top of pavement.

In addition to the above work six large concrete transformer pits are being built. The dimensions of these pits are 9 ft. x 20 ft. x 12 ft. deep, inside measurement. The pits will have 13-in. concrete walls and will be provided with special ventilation chambers. These pits are of sufficient size to take care of additional load in future years.

The above work is being done by contract, the G. M. Gest Company, Montreal, being contractors.

A feature of the work is a special tamping machine operated by a little gasoline engine. This requires two men to operate but accomplishes the work of several and does it better.

### Growth of Electric Vehicle Interests

The development which the year 1913-14 has witnessed in the electric vehicle field is phenomenal. Starting off last year in October the Electric Vehicle Association had but 437 members, with but two cities in which local organization had been organized. Since that time the membership has been increased to approximately 850—about 100 per cent—and the Sectional representation has expanded until it now includes New England, Chicago, Philadelphia, Washington, Cincinnati, San Francisco, Los Angeles, Pittsburgh, New York, Detroit, Cleveland and Toronto with expectations of having local sections in the immediate future in Buffalo, St. Louis and three or four other cities. In each of these local sections organized efforts are being put forth to promote the sale and use of electric vehicles, both passenger and commercial and it is safe to predict that these mediums will greatly facilitate electric vehicle development work in the year 1914-15.

Considerable progress has been made in the matter of the fifth annual convention of the Electric Vehicle Association, which this year will be held in Philadelphia, October 19, 20 and 21. All the convention committees have been organized and reports indicate interesting developments. To date the following tentative programme has been arranged.

Reports—Executive Secretary; Committee on Membership and Formation of Sections; Committee on Operating Records; Garage and Rates Committee; Insurance Committee; Papers Committee; Committee on Legislation; Committee on Educational Courses; Standardization Committee; Traffic Committee; Good Roads Committee; Central Station Co-operation Committee; Parcels Post Delivery Committee; Railroad Development Committee; Motion Picture Film Committee; Constitution and By-Laws Revision Committee; Report of the Secretaries of the Sections.

Papers—Progress of the Electric Vehicle; Unusual Application of Electric Trucks; The Motor Truck in Terminal Freight Handling; The Electric Vehicle in Parcel Post Service; National Electric Light Association's Electric Salesman's Handbook, with especial reference to Electric Vehicle Section; Electric Industrial Truck (Symposium); Educating the Public to the Field and Use of the Electric Vehicle; Electric Fire Apparatus.

### Large African Plant

One of the largest electric generating organizations in the world is in Africa where the Victoria Falls, the Transvaal Power Limited, and the Rand Mines Power Supply, Limited, under the same control, now have installed a maximum generating capacity of 182,000 kv.a. in 19 units and a capacity of 229,500 kv.a. in transformer units. The generators vary in size from 4,000 up to 18,000 kv.a. There is also at the present time in course of erection, by this organization, at Brakpan, two 18,000 kv.a. sets together with 37,500 kv.a. in step-up transformers which it is expected will be ready for operation in January, 1915. This will bring the total generating capacity of the plants of this organization up to 218,000 kv.a., and the transformer capacity up to 267,000 kv.a. Two high tension transmission lines are in service, one 136 miles the other 88 miles in length. Transmission on the former is at 80,000 volts and on the latter 40,000 volts.



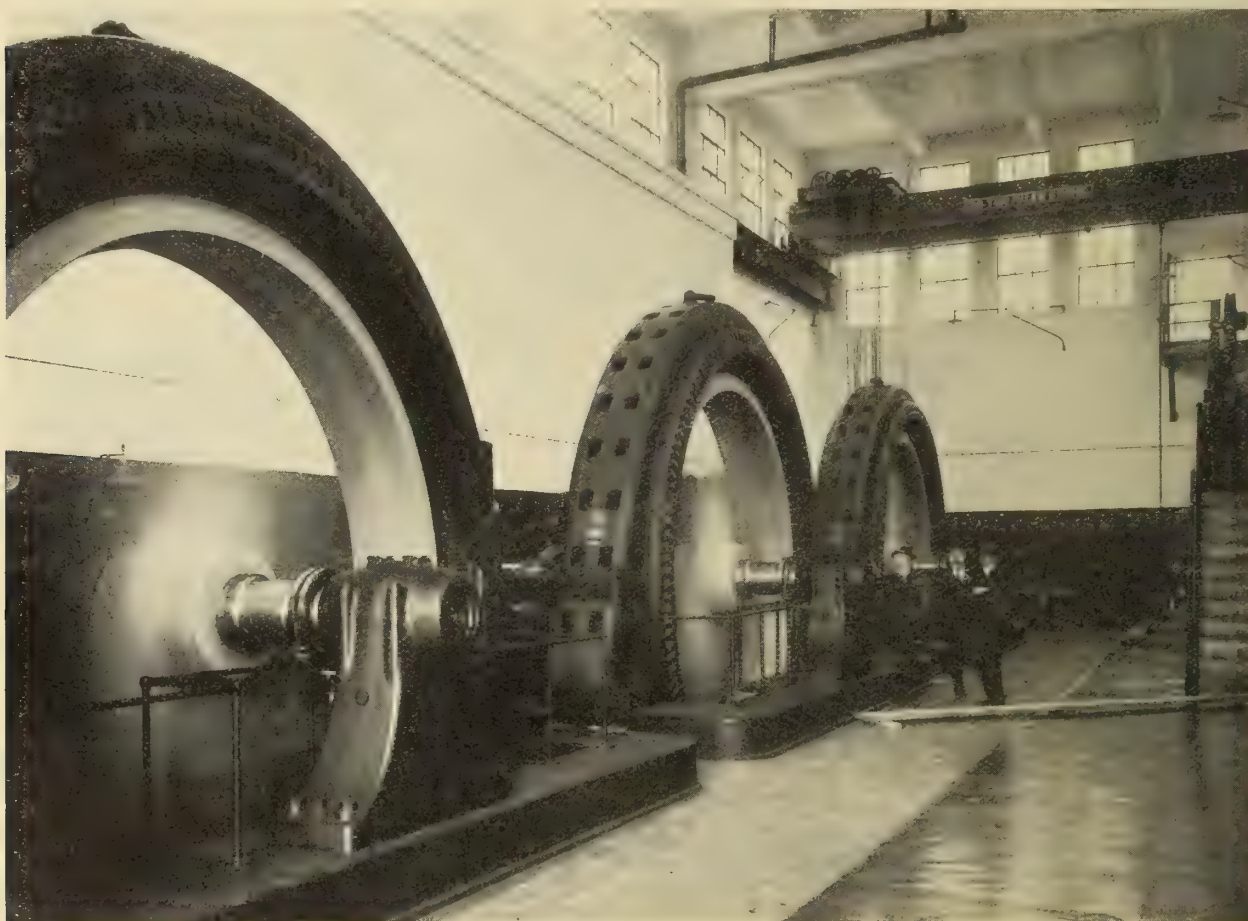
# New Hydro-electric Plant of E. B. Eddy Co.

**Three 4500 H.P., Four-Runner Turbines—High Efficiency Generators—Separate Motor Room and Pulp Mill—Latest Approved Construction Throughout**

The E. B. Eddy Company have recently placed in operation a 11,250 kv.a. hydro-electric station in Hull which derives its power from the Ottawa River at the Chaudiere dam within the city limits of Ottawa and Hull. The plant as completed consists of a power house for generating and a separate motor and pulp house where the electric current is utilized.

The power house is of reinforced concrete construction and presents a very substantial and attractive appearance. It is conveniently located almost in the centre of the Eddy company's factory buildings. The forebay has been com-

by this company to date. One exciter turbine has also been installed. This unit has a capacity of 130 h.p. operating at 425 r.p.m. under a 30 foot head. The design of the turbines and the plan of installation are shown in two of the accompanying sketches. Two of the photographs reproduced also represent one of the units under construction. These units have been specially designed to suit the operating conditions of the Eddy company and particular attention has been paid to easy dismantling and assembling of the various parts in case of accident. All bearings are oil lubricated and accessible during operation by means of channels connecting each



Generators, in operation, in the new E. B. Eddy Plant, Hull, Quebec.

pletely decked in with reinforced concrete arched work of sufficient strength to carry future factory extensions.

Into this forebay hot air from the paper machine room is exhausted by means of fans which is designed to maintain the temperature at such a point that anchor ice will not be formed.

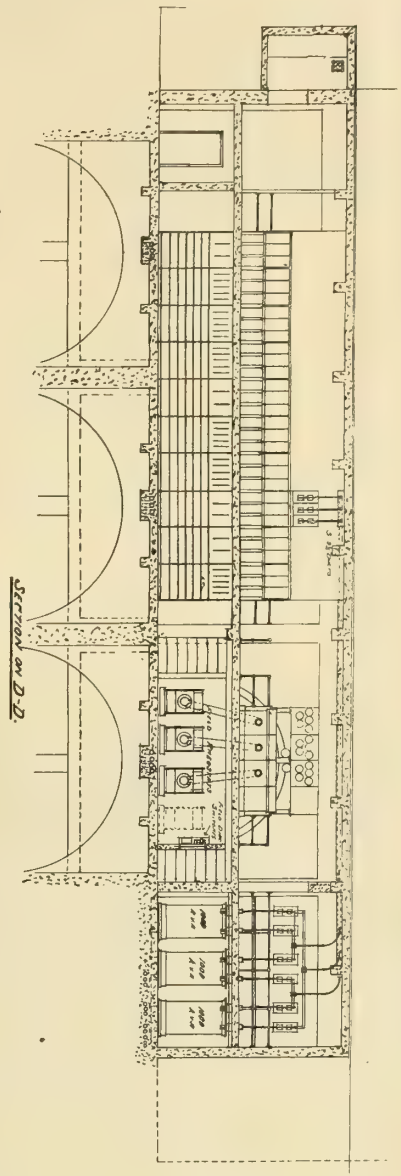
The head gates are operated by means of an electric crane which also runs over the wheel pit hatches.

The new plant comprises three units. The water wheels are of the horizontal open flume type, each unit having four runners operated at a normal head of 32 feet. At 164 r.p.m., each turbine is rated at 4500 h.p. The turbines are controlled by 60,000 foot pound horizontal type Lombard governors, said to be the largest of their kind manufactured

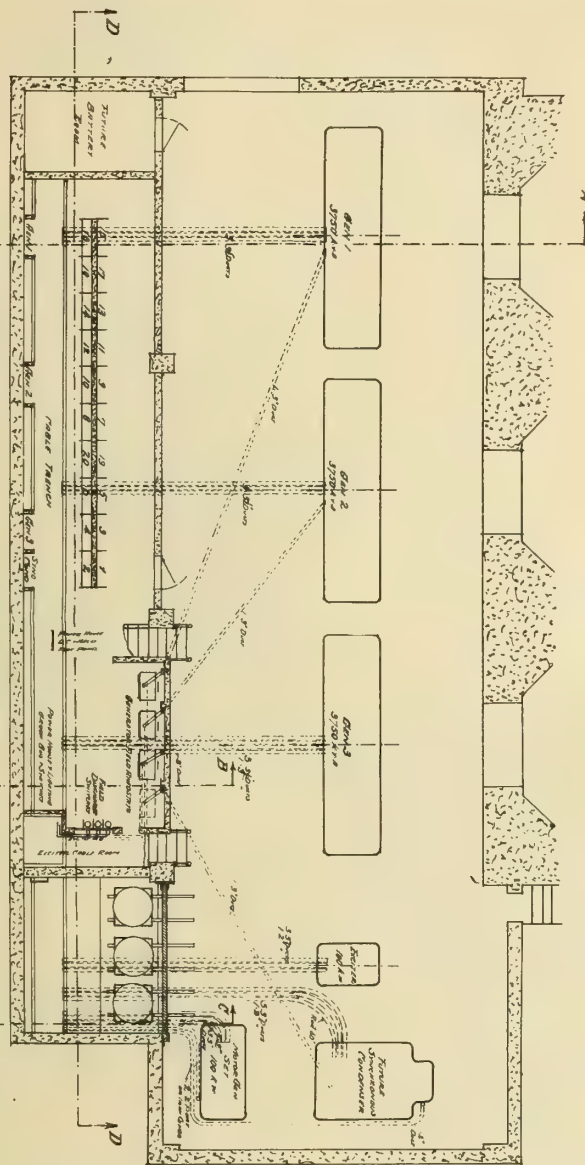
bearing pit with the generating room. The guide vanes are all cast steel. Each runner is pressed upon the forged hub which is one solid forging with the shaft and forms at the same time the coupling for connecting the next piece of shaft. The reproductions show sufficiently clearly the manner in which this work has been carried out. A feature of special mention is the construction of the runner, the buckets being of  $\frac{3}{8}$ -in. steel plate and welded into cast iron rim and hub by means of a special welding process. It is impossible for any of these buckets to come loose and experience has shown that the steel plate will tear rather than break loose from the cast iron.

As each unit is approximately 45 feet long special care had to be taken to prevent torsion in the gate shaft. The

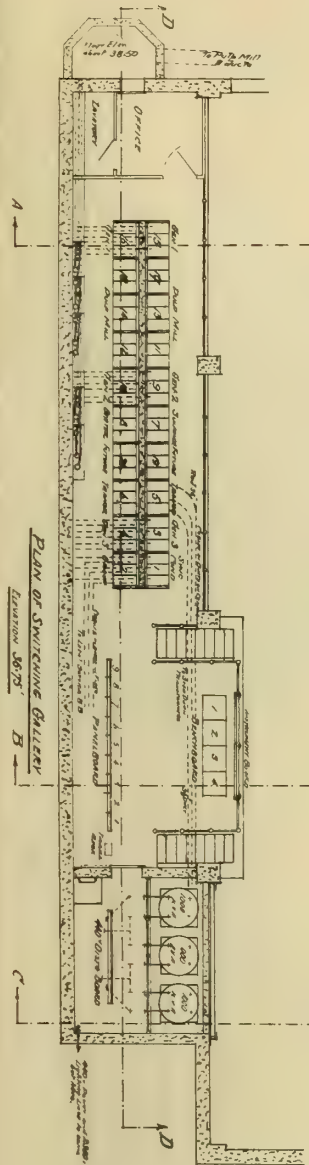




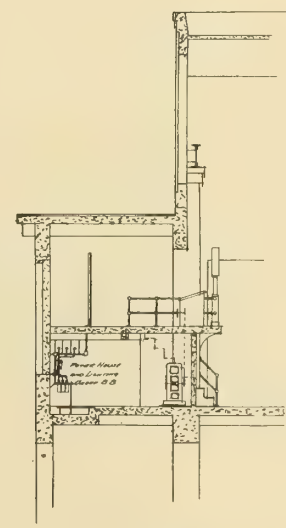
SECTION ON D-D.



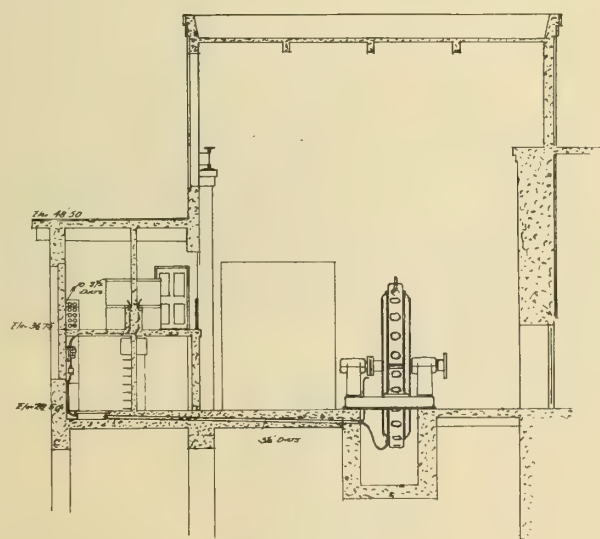
PLAN OF MAIN FLOOR  
SECTION 80-50



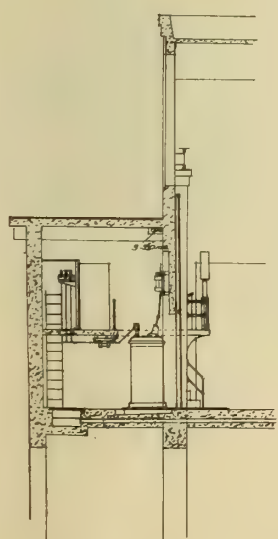
PLAN OF SWITCHING GALLERY  
SECTION 80-50



SECTION ON B-B  
Dwg No 12 4"



SECTION ON A-A



SECTION ON C-C

Plans and sections, new E. B. Eddy Plant, Hull, Que.

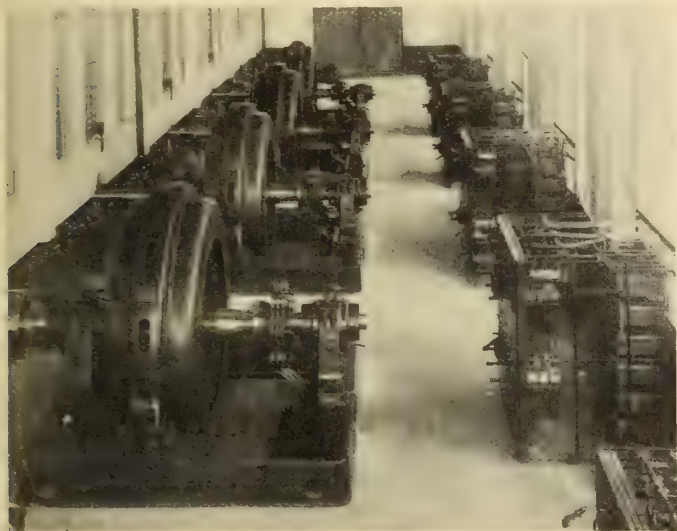






method used of connecting the gate shaft with the governor has proved superior to any other form of construction and careful measurements taken on the guide vane openings show that all vane openings are exactly the same in any position.

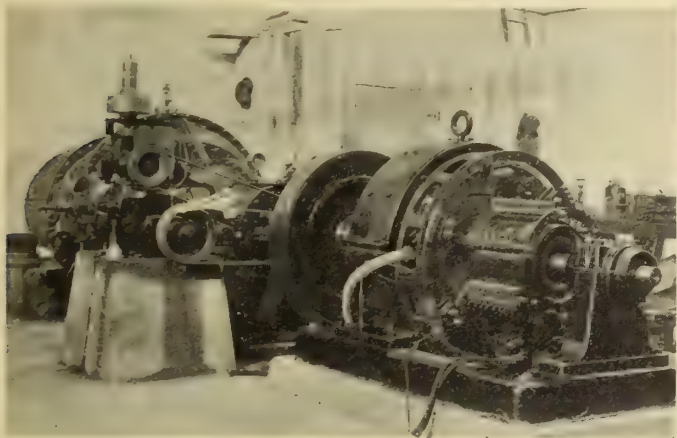
All bearings are furnished with stationary oil rings which carry the oil from the lower pit to the upper end, and a special wiper is arranged to wipe the oil off these rings and distribute it into the lubricating channels. These bearings at the same time have the advantage of acting as thrust



Motors are in a separate room from the grinders.

bearings and during operation have proved to be very satisfactory and to keep perfectly cool. The inside bearings placed in the draft chest are easily accessible and adjustable by means of bronze adjusting screws. They are of lignum vitae construction, lignum vitae strips being placed into separate cast iron shells.

During the test of these units it was demonstrated that they will develop 4800 h.p. at a little less than 31 ft. head and full speed of 164 r.p.m., and repeated inspections during the six months of operation have shown that all parts of the



Turbo-generator exciter, with fly wheel and governor.

machines are operating to the satisfaction of the purchaser.

The exciter turbine is of the end inlet type in cast iron casing. This is shown in one of the illustrations which also includes the regulator, regulating flywheel and generator.

As may be seen from the section drawing the turbines are of the open type being installed directly in the forebay. The exciter turbine, which is of the end open type, is set with its end in the wall which separates the forebay from the generating room.

### The Generators

The three generators installed are of the horizontal water wheel type and each has a capacity of 3750 kv.a., 2300 volts, 60 cycle, 3 phase when operating at 164 r.p.m. The power generated is used for driving induction motors located in a separate building and connected to pulp grinders, as well as other small motors connected to various machinery used in the Eddy plant. The stator coils of the generators are insulated from the laminations with mica tubes and the rotors, which are banded with steel rings, are constructed to withstand a 100 per cent. overload in the event of a run-away.

The guaranteed efficiency of these generators was as follows:  $1\frac{1}{4}$  load, 96 per cent.; full load, 96 per cent.;  $\frac{3}{4}$  load, 95 per cent.;  $\frac{1}{2}$  load, 93 per cent. As against this the results of the tests carried out in the workshops of the manufacturers by a disinterested firm of consulting engineers is of interest. These gave efficiencies as follows:  $1\frac{1}{4}$  load, 96.9 per cent.; full load, 96.6 per cent.;  $\frac{3}{4}$  load, 96.1 per cent.;  $\frac{1}{2}$  load, 94.7 per cent. These results are tabulated below for comparative purposes:—

Efficiency	$1\frac{1}{4}$	$1/1$	$3/4$	$1/2$
Result of test . . . . .	96.9%	96.6%	96.1%	94.7
Guaranteed Efficiency .	96%	96%	95%	93

The regulation of these generators also proved to be better than the guarantee. At full load, 100% power factor,



Bus and switch structure all concrete.

the guarantee was 8%, while the test gave 7.4%. At full load and 80% power factor the test was 14.8% as against a guarantee of 20 per cent, so that in all the tests the machines exceeded the guarantees by good margins.

The exciter turbine consists of a 100 kw. compound wound, interpole unit direct connected to the water wheel and operating at 450 r.p.m. There is also installed a 100 kw. motor-generator set running at 580 r.p.m. with an electrically operated equalizer switch.

The switchboards are placed on a gallery built over the bus chamber, step-down transformers and the electrically operated oil switches. The bus chamber contains two sets of busbars on to which any of the machines or feeders can be sectionalized, or the two sets of busbars can be run in parallel if desired. The bus and switch structure is all of concrete.

The generators are controlled from a bench board with electrically operated field switches and electric governor control. The instrument board for the machines is mounted on pedestals immediately behind the bench board. Each generator panel has three ammeters (one on each phase) a volt meter, power-factor meter and watt meter. There is also

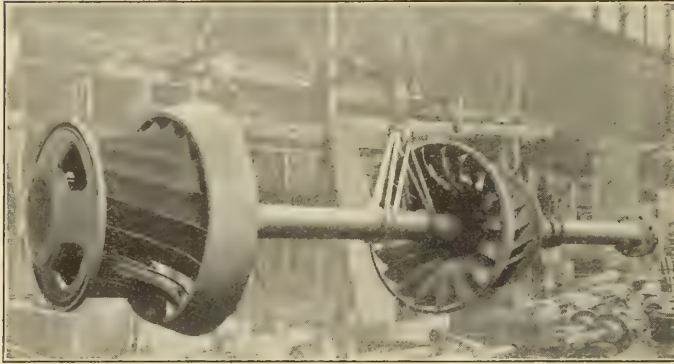


a frequency meter and volt meter on each set of busbars. The distributing panel for 2300 volt circuits is located on the other side of the bench board, as are also the exciter panels and the Tirrill regulator.

The transformer equipment consists of three single phase 1,000 kw., 2300/400 volt, oil-insulated, water-cooled, step-down units for paper mill service.

#### The Motor Room and Pulp Mill

A fine example of the increased efficiency and flexibility of large water wheels direct-connected to generators trans-



Turbine Runners, with steel plate buckets.

mitting power electrically to motors direct-connected to their load, over the old method of driving each group of machines by a separate small water wheel of doubtful efficiency with its usual supplement of belts, countershafts, etc., is well illustrated in the new pulp mill recently placed in service by the E. B. Eddy Company, of Hull, Quebec.

The Eddy Company realizing that their old pulp mill, in which each pair of grinders was driven by an individual water wheel, was very inefficient in the use of water, decided to discard it and erect in its place a modern hydro-electric plant. By so doing they could secure a better head of water and use units of high efficiency and transmit the power electrically to a new pulp mill in which the grinders were direct-connected to motors, also of high efficiency. The wisdom of this course has been quite evident by the increased output of the grinders and the saving in water used on the water wheels. Three 4,500 h.p. units installed in the power house have replaced 31 water wheels which were used in the old pulp mill and nine stones are now producing more pulp than



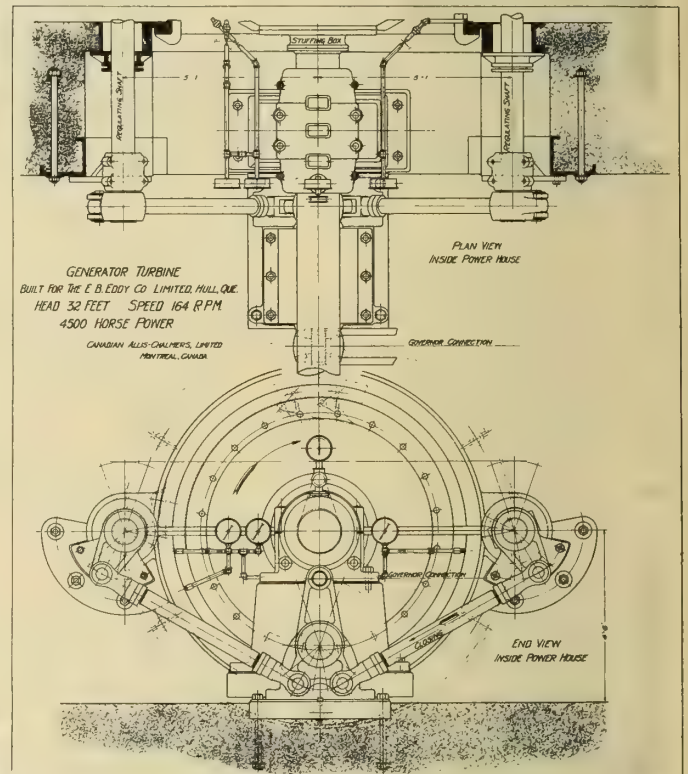
Turbine under construction.

18 stones did when installed in the old mill, due to the increased power and better speed regulation.

This new pulp mill is of structural steel and concrete, approximately 180 feet long by 130 feet wide and to give some idea of its size it might be mentioned that 400 tons of steel and 36,000 bags of cement were used during its erection. The mill is practically divided into three long rooms each 180 ft. long by 40 ft. wide, the motor room being partitioned off from the mill proper in order to keep out the moisture which is always present in a pulp mill.

The mill is designed for five main grinding units, each unit consisting of one 1,200 h.p. type "HF" 2,200 volt, 233 r.p.m. induction motor located in the motor room with the shaft extended through the wall into the grinder room where it is direct-connected to three 3-pocket New England grinders with stones 26 ins. x 54 ins. At present there are four such units installed, except that on one grinder a 34-in. stone is used to grind any wood that is too long for the 26-in. stones. Each motor is controlled by a four-panel black marine slate switchboard on which is mounted a main oil switch, ammeter, two relays and six starting switches for cutting out the secondary resistance of the motors. This switchboard is located directly opposite the motor it controls which makes a very simple and compact layout. An ammeter is also placed in the grinder room on each unit so that the operators of the grinder may see the load they are putting on the motors.

Provision is also made for two refiners, consisting of three stones on one shaft direct-connected to one 200 h.p. type "HF" 2,200 volt, 290 r.p.m. induction motor. The motor is placed in the motor room with the refiner connected to an



Plan and section showing turbine control.

extension of the shaft in the grinder room. At the present time one such set is installed. In the motor room there is also placed three 300 kw. 2400/440 volt transformers and switchboard to control same for supplying the smaller motors around the mill.

All of the electrical apparatus in the motor room is operated from the Eddy Company's new power house, about 800 feet distant, through five 450,000 circular mil 2400 volt cables.

In following the course of a stick of wood from the butting mill through the pulp mill to the paper machines it is interesting to note that outside the time it is barked and when placed in the grinders it is not touched by hand till it is made into finished paper in the paper mill. The wood goes first to the butting mill where it is sawn into two-foot lengths and from there it is taken by a conveyor to the wood room where are installed three Waterous barkers. The bark is here taken off and the wood is then dropped into a water



tank and from there it floats in concrete troughs to the grinders. After being ground into pulp it is pumped to the centrifugal screens where the slivers are taken out and from there the good pulp runs by gravity to the slush vats where the excess water is taken off. This white water, as it is called, is used again on the screens and grinders. After the excess water is taken off the finished pulp flows to the storage tank, which has a capacity of 75 tons dry weight—and from there is pumped by centrifugal pumps through two ten-inch pipes direct to the beating engines. The slivers that are taken out at the screens are not wasted but flow back to the refiners where they are re-ground and pumped back again to the screen and in turn find their way to the paper machine. The white water is filtered by three save-alls and the good pulp pumped also to the storage tank.

The capacity of the mill at present is about 85 tons of high grade pulp every 24 hours, but when the fifth unit is installed it will be about 105 tons per day. This capacity is figured when the grinders are making a very high grade of pulp and could be increased greatly if a coarser grade was tolerated.

In the wet machine room there are installed eight wet machines which make the pulp into laps for storage purposes.

The small motors in the mill are all wound for 440 volts, three-phase and fed from the main 440 volt switchboard in the motor room. All wiring is in conduit and each motor has its own starting panel close to the motor it controls. The electrical work throughout the mill has been installed in a first-class manner and is practically moisture proof. The coils of the motors have been specially impregnated and are also moisture proof.

The following is a list of motors installed and their connected load:—

H. P.	Speed	Type.	Connected Load.
1200	240	"HF"	Direct-connected to three 3-pocket New England grinders
200	300	"HF"	Direct-connected to refiner with 3 stones on one shaft
100	514	S. cage	Direct connected to countershaft for 8 wet machines
85	1800	S. cage	Direct-connected to centrifugal pump for grinders
75	514	S. cage	Direct-connected to countershaft for three centrifugal screens (mill designed for five screens)
60	720	S. cage	Direct-connected to centrifugal pump for pumping pulp from grinder pit to screens
40	1200	S. cage	Direct-connected to centrifugal pump for pumping pulp from storage tank to heaters—about 800 feet
55	720	S. cage	Direct-connected to countershaft for 3 barkers
50	1200	S. cage	Direct-connected to centrifugal pump for pumping water to wet machines
40	1200	S. cage	Belted to 14 slush vats
30	720	S. cage	Direct-connected to centrifugal pump for pumping white water to screens and grinders
30	600	S. cage	Direct-connected to centrifugal pump for pumping pulp from save-alls to storage tank
25	900	S. cage	Direct-connected to fan for blowing shavings from barkers to boiler house
20	514	S. cage	Direct-connected to centrifugal pump for circulating water in wood troughs
15	720	S. cage	Connected to three save-alls by countershaft

The electrical apparatus in the motor room as well as the exciter generator was supplied by the Canadian Westinghouse Company; the turbines by Canadian Allis-Chalmers, and the main generators by the Swedish General Electric, Limited. L. A. Herdt and William Kennedy, Jr., were consulting engineers.

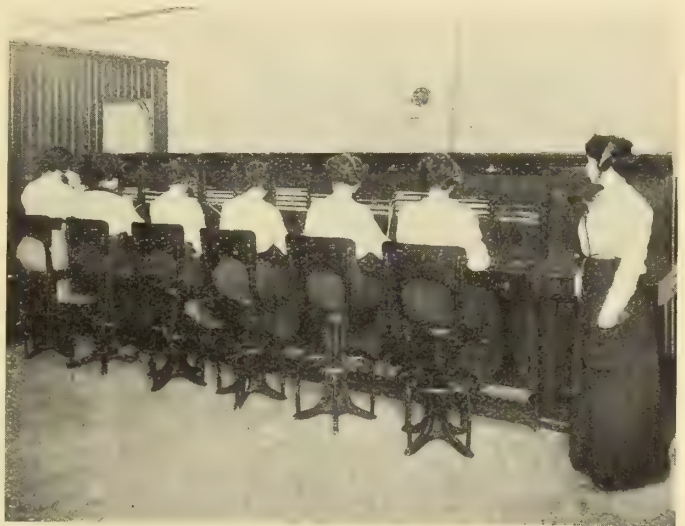
The Canadian Laco-Phillips Company have closed a contract with the Robert Simpson Company of Toronto for 500 units of 500 watt capacity each, nitrogen filled tungsten lamps. These will be used in connection with semi-indirect lighting bowls which are being supplied chiefly by the Jefferson Glass Company. The Macbeth-Evans Company are supplying glassware for the ground floor.

## Private Branch Exchange Switch Board

On July 18 a No. N4-D type private branch exchange multiple switchboard in the new Canadian Pacific Railway station was put into operation. The apparatus consists of six one-position sections and one cable turning section; each position is equipped with seventeen pairs of cords and double supervision. The line equipment consists of two hundred lines, with an ultimate of four hundred and twenty lines, thirty incoming trunks, and an ultimate of forty, also thirty outgoing trunks, with an ultimate of eighty lines.

The arrangement of the subscribers' multiple permits of a most rapid operation, being multiplied every three panels; every line is within easy reach of each operator; all lines, with their corresponding line signals, appear four times in the multiple; therefore any one of the six operators may answer or call every station; if necessary the traffic loads can be distributed to each operator by the insertion of colored lamp caps. The illustration shows the switchboard in operation.

The house and outside lines are brought into the apparatus room in two three hundred pair lead covered cables, and carried into the intermediate distributing frame in four one hundred and fifty pair cables, where they are formed out to their respective terminal strips, and connected with jumpers to the cabling to the switchboard; adjacent to the



Multiple six-position switchboard, new C.P.R. Station, Vancouver—the largest of its kind on the Pacific Coast.

intermediate distributing frame is placed the line and trunk relay, also repeating coil, racks, etc.

The power plant consists of two sets of seventeen cells each of type D-7 Electric Storage Battery Company's batteries, charged with a motor generator set, consisting of a 110 volt, 60-cycle, single-phase, 1800 r.p.m. alternating current motor, and a 7½ ampere, 45 volt direct-current generator, mounted on a suitable machine table. The ringing generator is supplied from an 80 volt generator, direct-connected to a ½ h.p., 110 volt, 60-cycle, single-phase, 1150 r.p.m. alternating current motor; the whole power apparatus is controlled by the necessary switches, circuit breaker fuses, volt and ammeter, mounted on a specially designed Monson, Maine, slate panel.

The equipment was manufactured and supplied by the Northern Electric Company, Limited, Montreal, and installed by the British Columbia Telephone Company's Switchboard Department.

A rejuvenation of the Sons of Jove, Montreal, will be held on September 15.



# Aluminum - Cell Lightning Arresters

By E. E. F. Creighton

Although the aluminum-cell lightning arrester is now many years old in practice, there is available in the Transactions of the Institute very little definite scientific information on this subject. It has seemed preferable to produce certain results rather than describe beforehand how such results were to be obtained. The practice of the aluminum arrester has now settled down to definite sets of conditions, and it is the object of this paper to consider standard conditions and open up the subject to discussion. Aluminum lightning arresters will be treated in general on points that may seem debatable. No detailed description of apparatus will be given herein.

The question is often asked—Will certain types of arresters be superseded? In very few cases has it been possible to give a definite answer to such a question, owing to incomplete knowledge of cloud lightning phenomena. It has been possible to say that if future investigations of cloud lightning prove that every lightning stroke is of high frequency and steep wave front, certain changes would come about under these conditions; it would be possible to prophesy, with considerable confidence, that many types of lightning arresters now in use would disappear. The natural growth of protection would be along the line of various types of high-frequency absorbers.

If, on the other hand, it should be shown that lightning is always of low frequency, and gives the surge a sloping wave front, then again, it would be fairly safe to prophesy the contrary—that very few of the lightning arresters now in use would disappear, and that probably no other devices would take their place.

Recent investigations of lightning phenomena have confirmed our views that cloud lightning has wave fronts of various degrees of steepness, and without question some of the lightning strokes are not high-frequency effects but are of the nature of simple impulses. The writer's recent experiences along this line have been gained by indirect methods. Lightning arresters have been put out which were sensitive to very high frequencies, and at high frequencies had very good protective qualities; but at very low frequencies their spark potentials were greater than at high frequency. Other arresters equally sensitive to both high and low frequencies have been installed in the same locality. This experience has indicated that many of the strokes are of low frequency. The most valuable and practical investigation of lightning arresters that has yet been made on a large scale has been carried on by Mr. D. W. Roper, and no doubt these results, which are incomplete at the present time, will be made available at some later date. More direct measurements of lightning taken with an oscillograph have been made by Mr. L. A. De Blois. These, I believe, are the most valuable direct tests that have been made in many years. I am personally indebted to both Mr. Roper and Mr. De Blois for information on their researches, and I understand that their valuable work will be presented to the Institute at some future meeting.

In the development of the present standard arresters our knowledge of lightning gave us no alternative but to assume that lightning had all the characteristic qualities of the various surges that could be produced in the laboratory. For example, we have assumed:

That the frequency might be from zero to 5,000,000 cycles per second.

That the wave front might be either vertical or angular.

That the quantity of electricity was both large and small.

We have known from our earliest investigations that several strokes came in succession. It was also necessary to take into account the effects of the energy from the generator which followed the lightning discharges. In this way we have endeavored to be prepared to meet any new information that might come concerning lightning strokes. Naturally, all these different factors could not be given equal weight in the design, and therefore, as more definite information regarding the nature of lightning is obtained, the designs will be strengthened in the features that these investigations may show are weak. It is a matter of increasing the ultimate efficiency by a small percentage.

The direct-current aluminum arrester is practically ideal from the standpoint of protection. It has no series gap and therefrom it gains two valuable characteristics: the first of these is the elimination of any dielectric spark lag; and the second is the absorption of high frequencies which have a less potential than the circuit potential. Commenting on these two conditions, the dielectric spark lag, although it is ever so small, is still appreciable as compared with the time of movement of a surge along overhead lines. A surge will travel a mile in about five millionths of a second. If the surge is a mile long, and the dielectric spark lag is five millionths of a second, such a surge will have passed along the line without starting a spark across the gap. The only means of discharging such a surge would be by introducing a choke coil in its path and thus delaying its movement sufficiently to allow the spark gap to become ionized. Since the spark gap of the a.c. aluminum arrester has a setting which may be only 25 per cent above the line potential, high-frequency surges can be deflected into the arresters if the potential either of the surge or the superposed value on the 60-cycle potential reaches the spark value. If the generated potential happens to be zero at the instant, it is evident that the surge itself must have a value 25 per cent above normal in order to cause the arrester gap to spark. The d.c. aluminum arrester, by its direct connection, is able to pick up surges of all frequencies and all potentials immediately on their arrival at the terminals of the arrester.

The practical demonstration of the protection afforded by these d.c. aluminum arresters confirms the theoretical work and experimental work tests made on the cells. The discharge rate at double potential is more than a million times as great as the leakage current at normal potential.

## Cost vs. Economy

From a practical standpoint, the cost of such arresters must be considered. While the cost and upkeep of the d.c. aluminum arrester is greater than for the older types using gaps and series resistances, still the aluminum arrester is the more economical one to use. The higher protection given by the cells would justify some increase in expense on account of the better service that can be maintained. But, as a matter of fact, the actual expenditure for the protection as a whole becomes less, due to the fact that good protection on the cars makes a less demand for the use of arresters along the trolley line. The saving in the cost of line arresters will more than compensate for the extra cost and upkeep of the aluminum arrester. Moreover, even with the very best types of gap arresters on trolley cars and trolley lines it is impossible in lightning-infested districts to maintain the car service. The percentage of protection from the gap type of arresters is not high enough even when the best arrangement



of wiring and choke coils is used in conjunction with the arresters.

There is one further function of the d.c. aluminum arrester that has considerable value, and that is the absorption of electro-magnetic surges coming from the interruption of accidental short circuits on the trolley line. Such high potential across loaded motors has a tendency to cause flashing around the commutators. If the flashing around the commutator is caused by the excess potential, then the d.c., aluminum arrester will relieve the trouble.

Answering, then, the frequently asked question—Will the d.c. aluminum arrester be superseded?—the answer is, in principle, no. Improvement in details may be made, and there may be discovered some new and better substance than the aluminum film, but none is yet known. Any degree of protection that is desired at its terminals can be obtained by the use of this arrester. An improvement in the length of life of the arrester is desirable, but this will not be superseding it. The discovery of some new substance that will give the same electric valve effect at a definite voltage only slightly above the operating voltage would be no particular improvement, unless perhaps it might be something that would not deteriorate when left disconnected from the circuit.

Turning next to the a.c. aluminum arrester, it was found impracticable to maintain simplicity and long life in the arrester and at the same time keep the arrester directly connected to the circuits. For this reason the horn gap was introduced in series with the aluminum cells. Since the hydroxide films on the aluminum plates gradually dissolve in the electrolyte it becomes necessary to introduce a method of charging the cells. The simplest method was first tried: it consisted of bringing the horns near each other and reducing the gap to a very small value. Many trial installations were made under these conditions and no bad effects were obtained. When the number of arresters in use ran up into the thousands, then an occasional trouble resulted from the rush of current into the aluminum cells.

The aluminum cells are condensers and as such will take initially a considerable rush of current. Furthermore, the dissolution of the aluminum films required a considerable quantity of electricity from the line to reform them. Where the films had been subjected to unusual dissolutions either by standing in hot electrolyte, resulting from atmospheric temperature or long periods of discharging, or from neglect to charge, the current rush into the aluminum cells became a serious menace, mostly to the arrester itself. Since there is no external indication of a bad condition of the aluminum cells, even an expert would be unable to know if it were permissible to close the charging gap of the arresters. This led naturally to the use of charging resistances in series during the ten seconds a day needed to charge the arrester. The charging resistance is an added expense and an added complication. But the added complication is relatively small, and the all-around increase in the safety of the arrester is great enough to justify both the cost and complication, from the user's standpoint.

#### Surges Accompanying Charging

The subject of possible surges accompanying the charging of aluminum arresters is one far more pertinent in an article written for foreign readers than in one for American engineers. The foreign operators seem to have had misfortunes with their arresters that have not been duplicated in America. The reason for this might be attributed to a number of different causes, depending upon the country and the localities. These reasons might be enumerated as methods and care in manufacture, the lack of definite and emphatic instructions to operators, poor distribution of insulation in transformer coils, and difficult situations caused by any one

of several factors, such as, for example—high temperature, bad regulation of the line, and insufficient care after an arrester had been called on to discharge continuously during an accidental ground.

The general results from any one or more of the foregoing enumerated factors may be classified under two heads: first, a short circuit in the arrester and consequent interruption on the line; and second, surges set up on the line without any damage to the arrester. Nearly all these conditions can be rendered harmless by the use of charging resistances. The one important exception is the matter of bad regulation of a line in which the power voltage is allowed to rise to values above the spark potential of the arrester. Under these conditions of discharge the arrester is no longer being used as such, but rather as a rheostat to absorb the generated power. The arresters cannot, at any reasonable expense, be designed to act as rheostats. While it might, in special cases, be possible to develop arresters which would withstand these conditions, the better solution of the problem is to improve the regulation. If care in manufacturing the aluminum plates and the electrolyte is not taken, and the installation made free of dirt and impurities in the electrolyte, more or less deteriorated conditions will exist throughout the life of the arrester. Certain kinds of impurities have a strong destructive effect on the films. A condition of unusually high operating temperature may call for an electrolyte especially adapted to high temperatures, or it may simply be taken care of by charging two or more times a day. Dissolution of the film from standing in hot electrolyte after the arrester has discharged continuously for a number of minutes can cause no trouble if a reasonable charging resistance is used, as the series resistance limits the current to a value which will not damage the arrester. With the exception, then, of high generator potentials from bad regulation of voltage, there is no difficult problem connected with the use of aluminum arresters.

A discussion of the aluminum arresters would not be complete without some reference to the possible surges that may be set up by the charging of the arrester. Surges on an electrical system may be considered in a list of ascending degrees of severity. Turning on an incandescent lamp sets up an electric wave on the system by calling on the generator for more power. A surge of this kind is of the third order of importance, and therefore, entirely negligible. It is well known that any spark or arc in the circuit containing inductance and capacity tends to set up oscillations, but if the resistance in series is equal to, or greater than, the critical resistance, oscillations will be prevented.

It is common practise to-day to open and close circuits which contain inductance and capacity without introducing in series a resistance to absorb the transient surges that are thereby set up. It is also common practice to-day to use circuit breakers to open accidental short circuits in which there is a high value of surge energy, and sometimes high voltages.

Going still a step further, every circuit is subject to accidental arcing grounds, which produce continually on the circuit dangerous surges which are often but slightly damped. It is difficult to protect apparatus from these most severe conditions of surges. In general, however, apparatus is built to withstand severe treatment, and there is but a small percentage of loss. Therefore, when we come to consider surges on the system we should take into account the conditions of insulation in relation to the severity of the surge.

#### Where Should Arrester Be Placed?

In all these graded degrees of severity of surges, where should the aluminum arrester be placed? If there were a demand for it, the arrester could be placed in the list next to the negligible surge of connecting an incandescent lamp



to the circuit, and this could be accomplished by using graded resistance in charging. In view of the insulation of the apparatus that is needed for the usual condition of operation and to withstand the inevitable accidents which cause severe surges from time to time, the use of graded charging resistance would be a needless and inconsistent precaution. It is sufficient to say that it could be done if it were desired.

What is actually done is more reasonable. A relatively large value of resistance is used in the charging circuit, limiting the current to a range of 5 to 15 amperes. Charging resistances are an intrinsic part of aluminum arresters as now manufactured. Strong recommendations have been made to operators to add them to their older arresters. A characteristic answer is to the effect that "our arresters have been charged through a gap for six years without trouble, and we are satisfied." The change is brought about not by reason of surges, unless they cause telephone interference, but rather on the ground that the arrester is made more immune from damage to itself.

In foreign countries, with their water jets and resistance types of arresters, the controversy over arresters still waxes as warm as it did here in the formative period some eight or ten years ago. The following argument is advanced against the aluminum arresters: admitting that the charging resistance does away with the surges, what about the heavy strokes which cannot pass through the charging resistance and therefore jump the main gap directly into the cells to ground? To anyone familiar with the practise here up to 1913 an answer is unnecessary. If this discharge path were a menace, devices could be used to mitigate it. The nature of the menace can be understood by a review of the past practise. There are several thousand aluminum arresters in use that have been charged through a gap without series resistance. Good practise now condemns the method, but there it is. Ten seconds' charge a day produces over a thousand makes and breaks. There would therefore be more than a million total made per day and more than a billion in a few years. Judging by the rare cases of trouble in this vast number it cannot be much of a risk to allow a few discharges per year to pass directly to ground through the aluminium cells, especially in face of the fact that such a surge is so dangerously large that it cannot be relieved through the resistance, and therefore the surge itself is an undoubted menace to the insulation as it runs wild over the electrical system at 186,000 miles per second.

The status of the aluminium arrester, therefore, is that of a device founded on the solid principle of a safety valve. It has definite limits of maximum current discharge rate and of energy absorption, beyond which damage to the arrester will result. In this respect it is no different from other standard apparatus. Years of experience have demonstrated that these limits are far above the usual demands of practice, but naturally it is not impossible to pass them. The flexibility to meet special conditions is great. Film area, internal resistance, relative gap settings, external resistance—all are readily adjustable to the demands which may possibly come as our knowledge of lightning and other surge phenomena is increased.

#### Discussion

**V. Karapetoff:** I would like to ask Dr. Creighton whether he has had any experience with the glass condensers and valves made in Switzerland and known there as the Moscicki condensers and Giles valves.

**F. W. Peek, Jr.:** It is some time since I have been actively connected with work on the aluminum lightning arrester. A number of years ago I had the good fortune to be able to make a study of lightning and the operation of the aluminium arrester on a practical line in Colorado. We

had the co-operation of one of the operating companies in the experiments on this system which was high up in the mountains. It was 17,000 volt network and a 50,000 volt main transmission, with a 50,000 volt idle line upon which to experiment. Various forms of lightning arresters had been tried by this company without success. It was practically impossible to continue operation during a storm. At this time the aluminum arrester was very new and we did not intend to make use of it as a practical protection; our idea was to make a study of lightning itself. However, in an attempt to improve operating conditions it was decided to install a few aluminium arresters. These arresters could not be obtained from the factory at that time. It was a very difficult country to get into. A sufficient number of aluminum cones was obtained, however; containing tanks were built in the mountains, and the electrolyte was compounded from chemicals bought at a local drug store. An arrester was thus built up and put into operation, and it did very good service. It was decided to install a few more. At a later period in the season these were obtained from the factory and were distributed to various sub-stations. During the latter part of that season there were very severe storms and very little trouble. Many improvements have since been made in the arrester, notably in the electrolyte and in the addition of charging resistance.

The aluminum arrester is the only arrester at present that can take care of a condition of high-energy lightning discharges of moderately steep wave front or moderate frequency. This is often the only condition; generally the prevailing one that must be met. Good protection is thus obtained in the majority of cases with an occasional miss during the season. There are certain conditions, generally in the minority, but which occasionally on a few systems are the prevailing ones, which no arrester with a gap can, unaided, satisfactorily take care of. These conditions are:

1. Lightning impulses of exceedingly steep wave front and high voltage.
2. Impressed high frequency of a voltage insufficient to discharge the gap.

In condition (1), the dielectric breakdown time lag of the gap may prevent discharge of the arrester before discharge takes place at some weak point in the system.

In condition (2), discharge does not take place at the gap because the voltage is not high enough, but the oscillations may build up high voltage internally in an apparatus containing inductance and capacity.

Both conditions, (1) and (2)—which may be considered as more or less special—may be taken care of by the proper arrangement of resistance, inductance and capacity.

Good engineering requires as high system insulation as is economically possible, with the weak point at the lightning arrester.

**L. C. Nicholson:** Electrolytic lightning arresters are coming to be very widely used, and I think by this time they are recognized as the standard type of station arrester.

Frequently the question is asked—Are they efficient? Are they necessary? We operating people reply by saying, "Yes, they are necessary, if you think so," the result being that most of us are afraid to leave them off. As far as I am acquainted with the operating results of this type of arrester, there is seldom any apparatus damaged when protected by such an arrester, and I will also say that when the apparatus is not protected by such an arrester, there is very seldom any damage. So it appears that the arrester is all right. Except on extremely highly insulated transmission lines, damage to high-tension apparatus in the station by lightning is rare.

Usually lightning effects are so localized that the line has its own trouble and keeps it. I am acquainted with an installation which uses a pretty wide gap between the line



conductor and earth, say 100 per cent. over voltage, which discharges once a year, and which seems to be about all the protection that the station apparatus really needs, judging from the fact that no station apparatus has been punctured. I am acquainted with other stations which have electrolytic lightning arresters and which are not troubled by lightning, and I am acquainted with some which have electrolytic lightning arresters and are troubled by lightning, so that it is very much of a question as to whether lightning will or will not do damage under certain conditions of station protection.

At least, the aluminium electrolytic lightning arresters have been developed to a point where there is no longer any danger of their exploding or giving any trouble on their own account if properly cared for, and the usual station attendant, with sufficient instructions, can properly care for the arresters and keep them in proper service. I feel sure that the addition of charging resistance has been of great benefit to the operation of this arrester.

The pity is that these arresters cannot extend their influence beyond half a mile from the station. In most cases the trouble is beyond that point.

**C. O. Mailloux:** Reference has been made to the character of the "front" of the wave which strikes a line or a portion of circuit protected by lightning arresters. It is known that the vertical front of a wave may be flattened out and sharpened to a point, so to speak, in passing through a reactance. It would seem therefore, as if one might expect that the character of the wave-front would depend somewhat upon the distance from the apparatus at which the lightning strikes the line. One might expect that the lightning striking the line very close to the lightning arresters would produce a current-wave having a squarer, straighter front, a more vertical one, than if it struck at some distance, owing to the difference in line-reactance. It may be that in most cases this would not make much difference. In any case, it should be possible to alter the wave-front, to some extent, by the introduction of artificial reactance.

**C. P. Steinmetz:** I wish to refer to only a few features. Setting aside failures of insulation due to weakness of poor design of bushings, insulators, etc., it occasionally happens that even a good lightning arrester fails to protect coils of transformers. The explanation of this is a feature which I have endeavored to make clear in my paper. These failures mean merely that when we speak of lightning we do not know the nature of the surge, and it is necessary to make such studies as will determine it—why at times the surges cause damage and other times they do not.

The aluminium arrester, with a gap in series, may protect against any surge which reaches the aluminum cells. Any disturbance of a voltage less than that which will jump the gap and thus reach the aluminium cells naturally cannot be absorbed by the aluminum cells. Therefore, if we have a high-frequency oscillation of a voltage sufficiently low not to jump the spark gap and incidentally sufficiently low not to do any damage to the line, such a voltage may not be able to do harm to the insulation from line to ground, but when massing of the surge occurs in a few turns of reactance such as a single coil of a transformer, it may do very great damage because, while the apparatus is designed to stand the line voltage, it is not designed to stand half the line voltage across say one-hundredth or one-thirtieth of the circuit. The main trouble, due to high frequency, comes from the local massing of voltage across the reactance.

In speaking of high frequency we may refer to various different effects, and we also usually mean a thing which is not high frequency at all, is not even oscillation—it is steep wave front. A steep wave front, to some extent, causes the same trouble, namely the same massing of voltage, but in other respects it is very different. Some types of protective

devices, like the multi-gap arrester, are very sensitive to high frequency, and will discharge high-frequency surges of voltages much less than the operating voltage, but they are not sensitive to steep wave front and may allow steady voltages of steep wave front to rise far above the circuit voltage without discharging.

Another illustration of this difference is given by the application of a condenser. Where there is very high frequency, a condenser shunted from line to ground may bypass or practically short-circuit the high frequency, but where there is an uni-directional wave the condenser will take a charge and thereafter offers no obstruction to the rise in voltage.

We must realize that electrostatic capacity is not a lightning-protective device—is not by itself a protection. A capacity from line to ground merely is a thing which will charge and store the energy. The storage is transient and the energy in the condenser must be returned to the circuit. Thus the condenser in the line will have no effect at all on steady voltage, or on low frequency. The favorable action the condenser can have is apparently to short-circuit disturbances of relatively high frequency.

Such disturbances, in my opinion, are rare, if they exist at all on transmission lines. For the reason that the capacity of the transmission line is so large, compared with the capacity which can economically be provided for in a condenser, any small condenser which can be shunted across the lines at the station would not be capable of appreciably short-circuiting the surge. Thus the high-voltage and the high-frequency disturbances of such volume and such current as can come in over the line are not cared for by any condenser of practicable size.

It is different when the surge comes from the other direction—that is, where the high-frequency disturbance comes from the station. In the transformer, as in the line, the circuits have distributed inductance and capacity, but in the transformers the inductance is very much greater, and the capacity very much less than in the line, and therefore the ratio of voltage to current of the disturbance is very much greater. In other words, capacity has an appreciable effect on a traveling wave, when the capacity is shunted around the high-potential windings of the transformer.

The value of capacity in protective devices lies in the fact that it is a barrier against the passage of current at machine frequency without being a barrier to the passage of surge currents which are inherently of high frequency. Under these conditions it is possible to use a resistance of low value in series with the condenser without absorbing any appreciable power at machine frequency. At high frequency, however, the power factor approaches unity and the maximum possible energy of the surges is absorbed. Thus it is seen that it is not the capacity in itself that is protective, as the voltage absorbed by the capacity at high frequency is negligible, but it is the capacity allowing a properly proportioned resistance to give protection by absorbing the energy of the wave.

This is the condition in the aluminum electrolytic cells, where there is a high equivalent resistance in series with the natural capacity of the cells.

The capacity of the aluminium cell gives a moderate power factor at average machine frequency, but when there is applied a frequency of 100,000 cycles, the power factor of the aluminum cell is practically unity, that is to say, practically all the high-frequency current which goes through the cell is dissipated as energy and does not store itself as energy to be turned back into the circuit, as would be done by a simple capacity.

I believe that the action of the aluminum cell can best be represented by calling it a counter-electromotive-force device. It acts as a counter-electromotive-force shunt between



circuit and ground after the voltage has reached a definite value. Up to this definite value, i.e., discharge voltage of the spark gap, it is an open circuit, and beyond that voltage is a closed circuit. In the closed circuit condition it has about the same effect as if in a d.c. system you shunt a storage battery from the trolley wire to the ground. If you connect between the trolley wire and ground a 600-volt storage battery, then no lightning or any other disturbance will be able to raise the voltage of that trolley line appreciably above 600 volts because any attempt to raise the voltage would merely cause a discharge through the storage battery. The discharge rate depends on the internal resistance and voltage above the polarization of the storage battery; so it is in the aluminium cell, where the discharge rate depends on the voltage in excess of the polarization value and on the internal resistance of the cell, which, as we all know, is very low.

Now, as to the possible danger from the use of the aluminium cell, which has been especially discussed by those who have had very little practical experience with it—that is, the question whether it may produce high-frequency oscillation. One argument against the production of high frequency I have mentioned already the power factor of the aluminium cell is unity and it has no capacity effect at high frequency, but it gives a thoroughly damped circuit of a resistance which prevents oscillations. But from another view-point, the best comparison is that given by Professor Creighton—it is a safety valve from line to ground, of very high discharge rate.

We would not think of installing a high-pressure steam boiler without a safety valve, and still, many of us know that every once in a while you hear that a safety valve is really a source of danger, because if a steam boiler is superheated, and water is low, and just at the point where it is near blowing up, and if the safety valve operates, then the sudden shock of the safety valve opening may set off the explosion. But that is no reason for saying that it is unsafe to use safety valves and that all the steam boilers should be operated without them. It is exactly the same case with the aluminium cell or any protective device. If you protect the system against over-voltage, and if the energy back of the over-voltage is very large, it means that to relieve the over-voltage strain we have to provide a device with a high discharge rate, and the sudden coming into play of that high discharge rate, which is required to relieve the strain, means a sudden shock to the system, and if you are near the breakdown point, that very shock may cause a breakdown.

But it has been said that it is not necessary to have a free discharge, and that a resistance may be inserted between line and ground—a critical discharge resistance which will gradually relieve the voltage without oscillations. That is very nice. By so doing the shock is removed only by keeping the excess voltage on the line and the apparatus for a considerable time, and for the time, in fact, that it takes to discharge, and since the disruptive strength depends on the time of applied voltage we wish to relieve, we must conclude that we are between two extremes. We have a condition of excessive voltage brought on by lightning or other disturbances. This voltage is dangerous, is certain to destroy apparatus and line if it stays long enough. We may gradually relieve, or we may suddenly relieve, but since the voltage is certain to destroy, the most effective way is to relieve it as quickly as we can, even if in the extreme case the very suddenness of the relief may accelerate the damage, which is, however, very improbable. I do not know of any instance where this has occurred, and I think the point raised in this connection is more theoretical than actual.

There is one point I want to mention about steepness of wave front. The steepness of wave front depends on the distance of the place from the point where the wave origin-

ates. Theoretically, if you calculate transient phenomena of the line, you will find, by an equation, that the wave shape is so steady that the wave starting as a steep wave front retains its steep front all over the line. Practical experience shows that this is not so, and that is one of the various points where theory and calculation do not agree, or where, in our theory, we make an assumption which we find is not warranted—that is, we assume the effective resistance and effective conductance to be constant, independent of the frequency, while in reality every decrement increases with increase in frequency.

If you assume that the effective resistance of the line is a function of the frequency, increasing with increasing frequency, then you would find in the equations (if the equation did not come out so complicated) which so far have been beyond the mathematical skill brought to bear upon them, that the steepness of the wave form decreases with increasing distance traveled by the wave.

But while the equations have not yet been solved to give the values of the increase in resistance of the line, experimental evidence is available. There were some very interesting tests, for instance, made by Mr. Faccioli some years ago, on the wave produced by opening the high-tension switch in a 90,000-volt circuit. In that case, at and near the point of opening of the switch, the steepness of the wave front was such as to give, across a choke coil the inductance of which was equivalent to 50 feet of line, a potential difference of 30,000 volts, but the same size of coil on the same line at 20 miles distance, gave no appreciable steepness of wave—that is to say, in the switching test there was no discharge on the spark-gap shunted around this small reactance. Within 20 miles of travel the wave front changed from an extremely steep one to a very flat one. This is the experimental evidence of the high-resistance offered by the copper line wire when the potential is suddenly applied.

**E. E. F. Creighton:** I feel that there is no need to say anything further about the Moscicki condenser, in answer to Dr. Karapetoff's question, as Dr. Steinmetz has already covered the subject.

I am glad that Mr. Nicholson has thrown a little spice into the controversy by speaking of the cases where apparatus was not damaged and the arresters were installed, and also cases where the apparatus was not damaged and the arresters were not installed. Each one of us speaks from his experience, especially his own personal experience, and Mr. Nicholson, I take it, is speaking from his. If I may be permitted, I would like to analyze some of the conditions under which he has been operating and then contrast them with some other experiences which have been gained on other transmission lines where the conditions are different.

On that particular system to which Mr. Nicholson referred there was, a few years ago, an almost insurmountable problem of keeping the lines operating during thunderstorms. I have the greatest admiration for the way in which Mr. Nicholson has attacked this problem and obtained a workable solution. The point of it was that the insulators on the line had not only less factor of safety than they needed, but they punctured, and where every insulator on the line is a lightning arrester it is quite true there is less need of lightning arresters in the station. Under these conditions the principal need of a lightning arrester in the station is where the lightning happens to strike in the neighborhood, and that, I think, corresponds to Mr. Nicholson's remark that it is too bad the lightning arresters cannot reach out more than a half-mile from the station. I should say that it is too bad the lightning is so terribly concentrated at points on the line. That represents to my mind the experience gained in that particular case.

On two other lines I know of, where the insulation of



# Present Status of Prime Movers

## A Very Valuable Report on the Latest Developments—Summary of Investment and Fuel Cost. (Continued from Aug. 1.)

By H. G. Stott, R. J. S. Pigott and W. S. Gorsuch.

zontal, single or multiple, material in runner, which may be made of cast iron, cast steel, gun metal, bronze, etc., depending upon the service conditions, are some of the factors that cause the price and weight to vary materially. With a given head, the greater the power of the turbine the less the unit cost. With a given head and power, the higher the speed the less the unit cost. On the other hand, with a given power, the lower the head the greater the unit cost. For illustration, a water turbine developing 50 h.p. under a 30-ft. head, and costing \$18 per h.p., will develop approximately 300 h.p. under a 100-ft. head, and will cost only \$3 per h.p., assuming other conditions equal. In reality the cost of the turbine under the 100-ft. head would be slightly higher than \$3 as the construction would naturally be more expensive.

In general it can be said that the cost of hydraulic turbines and generators larger than 200 kw. capacity will vary from \$30 to \$10 per kilowatt installed, exclusive of foundations.

With the broader field now covered by turbine design and construction, the necessity for careful selection has become most important, and the hydraulic engineer can at the present time secure hydraulic turbines of the best character and design only by careful attention to the intelligent analy-

As it is not within the scope of this paper to include operating and maintenance costs for the entire plant, investment costs of the units and fuel costs are shown plotted in conjunction with the percentage of normal full-load rating in Figs. 16 and 17, for making an economic study of the various types of prime movers.

The impression that gas and oil power invariably imply a lower cost of generation is constantly losing ground through the critical analysis of the elements of power costs.

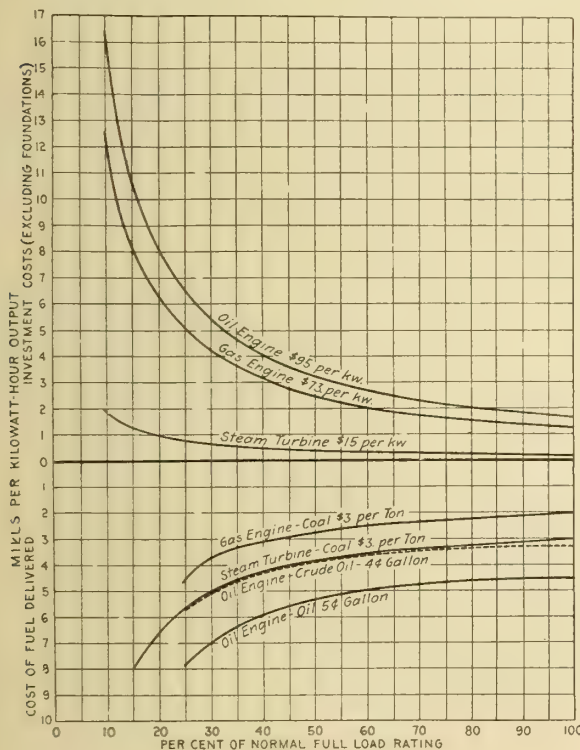


Fig. 16.

sis of turbine possibilities, and the selection of wheels suited to the particular conditions of head and load under which such turbines are to operate.

### Finance and Economics

#### Investment and Fuel Costs.

(a). Heat Engines.—In comparing the various types of prime movers, conclusions are often reached, largely from a study of the cost of fuel, without any reference whatever to the total cost of power and the relative investment costs.

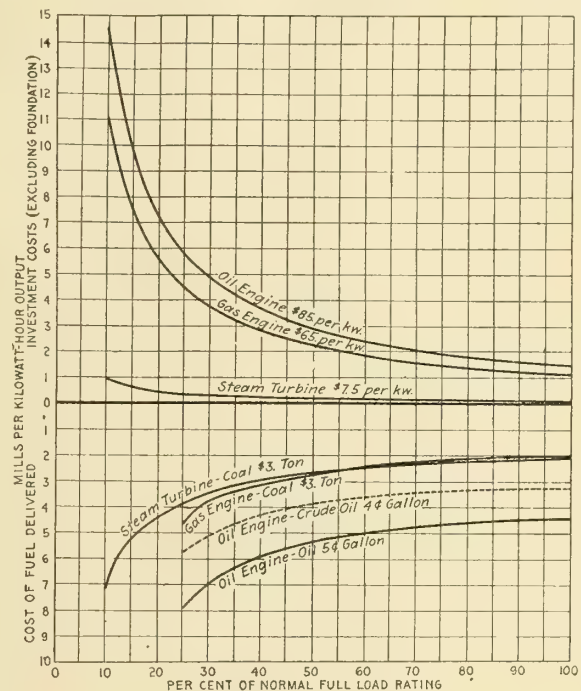


Fig. 17.

Fuel is only a fraction of the total cost of power, and there are conditions where it is overbalanced by other costs.

Claims have been repeatedly made that steam turbines use two and one-half times the amount of fuel consumed by gas engines, but these statements are without foundation. Before any fair comparison can be made of fuel consumptions, records should be kept over a reasonably long period and the coal reduced to a common basis as to B.t.u. per pound and the percentage lost in refuse.

The curves plotted in Fig. 16 are for small machines of 750 kw. capacity—the steam turbine a single unit costing \$15 per kilowatt, the gas engine a single unit costing \$73 per kilowatt, and the oil or Diesel engine a double unit costing \$95 per kilowatt. These prices are for the prime mover and generator delivered and erected (exclusive of foundations) within 600 miles of the factory.

The investment costs are taken at 11 per cent for the steam turbine and 15 per cent for the gas and oil engines. In investment costs are included interest, taxes, insurance and amortization fund, that is, an arbitrary percentage that should be set aside and the percentage corrected, if necessary periodically, so that when the apparatus is condemned on account of obsolescence or inadequacy, there will be a fund which will meet the expense (see "Power Costs" A.I.E.E. Proceedings, May, 1913).

Coal for both the steam turbine and gas engine is taken



at \$3 per ton having 14,500 B.t.u. (3,654 large calories) per lb. delivered alongside the dock. On account of the wide fluctuation in price of the same oil at the same locality, two figures are used, namely, four and five cents per gallon. All auxiliary costs are included, but stand-by costs are not, as these vary widely with the conditions of operation.

Adding the investment and fuel costs for any percentage of normal full load rating, the steam turbine will be found to be slightly less than the gas, and considerably less than the oil engine. Even with stand-by losses allowed, the turbine will still have the advantage over the gas engine loads below 80 per cent full load rating.

The investment costs are computed on the normal full-

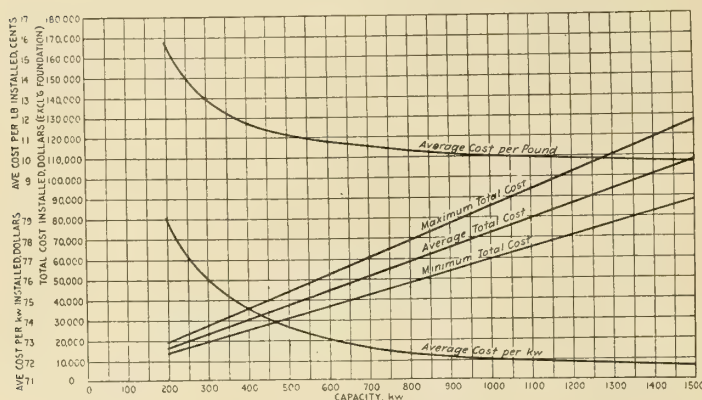


Fig. 18.

load rating, and if advantage is taken of the overload capacity of the turbine which is approximately 25 per cent for 24 hours, the cost per kilowatt-hour during such periods of maximum capacity will be less than shown by the curve. This does not apply to gas and oil engines, as what little overload capacity may be allowed in these machines is for a short period of two hours or even less.

Another set of curves is plotted in Fig. 17, showing a single turbine unit of 20,000 kw. capacity, costing \$7.50 per kilowatt, ten 2,000 kw. gas-engine units costing \$65 per kilowatt, and forty 500 kw. oil-engine units at \$85 per kilowatt. In a plant of this capacity the gas and oil engines are practically out of the running with these fuel costs.

In computing the cost of fuel the coal was put on the same basis, namely, 10,825,000 B.t.u. (2,727,868 large calories) per dollar, whereas the oil at 4 cents per gallon is equivalent to 3,718,000 B.t.u. (936,925 large calories) per dollar. This may look as though the steam turbine and gas engine were being favored but in comparing prime movers as they stand to-day they must be considered in connection with the prevailing cost of fuel. While it is possible to get a cheaper coal than \$3 per ton with 14,500 B.t.u. (3,654 large calories) per lb., it is a question whether many more B.t.u.'s (large calories) of natural oil per dollar can be obtained, except in a few localities.

If natural instead of producer gas is considered it would cost about 10 cents per 1,000 cu. ft., which is a reasonable figure, as the price varies from 5 to 25 cents per cubic foot, depending upon the location of the well.

At 40 per cent of normal full-load rating the investment cost for the gas engine is approximately 90 per cent of the fuel cost and for the oil engine using oil at four cents per gallon it is about 80 per cent, whereas with the steam turbine it is only 7 per cent.

If we assume for illustration, that in a small plant it is possible to obtain a horizontal semi-Diesel installation, including engine and generator delivered and erected, excluding foundations, for \$73 per kilowatt, and that oil can be purchased for 3.5 cents per gallon delivered, it will be seen from Fig. 16 that while the cost of fuel will be slightly in favor of the oil engine, the sum of the ordinates above and

below the axis for any percentage of load will be in favor of the steam turbine. With larger installations it will be seen by referring to Fig. 17 that the turbine has decidedly the advantage.

All these illustrations are on the basis of the normal full-load rating of the plant, however, if reserve capacity is allowed for to insure continuity of service, the investment costs for the gas and oil engines will be proportionately higher than for the steam turbine.

From a study of these curves it will be seen that the ratio of cost of steam to gas and oil units is decidedly in favor of the former so that gas and oil power becomes severely handicapped in large work owing to the proportionately greater investment burden. And, unless the price of coal rises materially above the present value, the gas and oil engines will find limited application in stations of any appreciable size, except under very favorable circumstances, where natural gas, by-product gas or some artificial fuel oil can be secured at low prices. If maintenance cost and the additional investment cost required to assure reliability or continuity of service are included, the steam turbine will stand out more prominently.

(b). Hydraulic Turbines.—The redeeming feature of the water turbine, which gives it an advantage over other prime movers, is the absence of fuel. As a result, the operating expenses are practically the same whether the plant is working 10 or 24 hours per day. On the other hand the investment cost is influenced by the load factor, but it is doubtful in any case whether the water turbine and generator will exceed twice that of the steam turbine and generator on the basis of 11 per cent. When the investments costs include an adequate supply of auxiliary capacity to supplement the deficiency in stream flow, the difference between the investment costs of prime movers plus the fuel costs, at any percentage of normal full load rating, will not be so marked, as the investment costs of the units of the hydro-electric plant will not only be much higher than a straight steam plant, but in addition, there will be fuel costs for the reserve units. In fact, with the same class of service, and the reliability charge in the form of duplication of units or steam reserve,

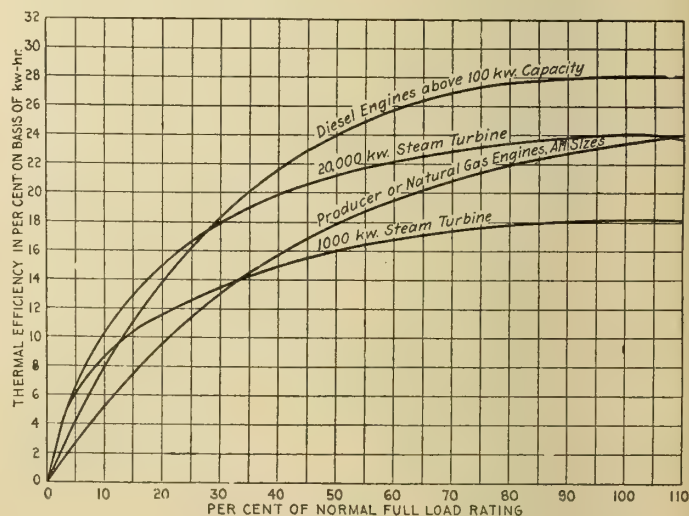


Fig. 19.

the straight steam turbine units will in many cases be more economical.

In low-priced fuel districts the hydraulic turbine is only a competitor of the steam turbine where the development costs are moderate and the load factor reasonably high.

More attention is now being given to the important relation between the efficiency and durability of the water turbine than has been in the past. It is the opinion of some engineers that the most efficient turbine, if operated too constantly at low gate opening is likely to show some pitting



if the head is high, and they recommend that turbines of high specific speed be kept as closely loaded as possible to the point of maximum efficiency, while with turbines of lower specific speed it is not necessary to operate within such close limits.

General.—The proportion of the total investment cost of a 20,000 kw. plant represented by the prime mover and generator for the various types of units, is approximately as follows:

Prime Mover	Total investment cost per kw.	Cost of prime mover and generator per kw.	Percentage of total investment
Steam turbine ... ..	65.00	7.50	15
Gas engine ... ..	140.00	65.00	46.5
(Producer gas)			
Oil engine ... ..	120.00	85.00	71
Hydraulic turbine ....	125.00	12.00	9.6

The unit costs are the average values obtained from the cost curves given above, while the total costs were estimated and are only approximate, especially in the case of the oil engine, as it is impossible to obtain reliable data for this type of installation.

Considering the different types of prime movers in connection with the total investment cost of the plant it is evident from a study of curves similar to Figs. 16 and 17, developed on a load factor and total cost basis, that with a very poor load factor the all-important point is to keep down the fixed charges, as they are of vastly greater importance than any possible gain in efficiency due to a better type of prime mover of the same class. This is true of any plant, and the curves will show the futility of attempting to carry peak loads by means of water turbines, gas and oil engines or any prime mover that necessitates a large investment per kilowatt.

Efficiency and Heat Consumption—Figs. 18 and 19 are presented to show conservative thermal efficiencies and heat consumptions in B.t.u. per kilowatt-hour at different percentages of normal full-load rating, for two sizes of steam turbines and for all sizes of gas and oil engines, reckoned on the heat in the steam, gas or oil delivered to the throttle valve, and do not include boiler or producer losses or auxiliaries.

An important feature of the steam turbine and especially the oil engine, is that the efficiency does not materially decrease until the load falls below 25 per cent of the normal rating, whereas the gas engine changes rapidly.

In small plants with a low load factor, efficiency may be a secondary matter compared with investment cost, and the cost of maintenance and reliability.

Maintenance and Reliability.—On account of the high mechanical stresses inherent in the gas and oil engines, and heavy reciprocating masses, there is necessarily greater maintenance and repair cost, also a lower reliability of service and a higher class of attendance than for either the steam or water turbine units. The reliability of the gas and oil units has not been sufficiently established to warrant their adoption for reasonably large power stations operating 24 hours daily, without the plant being over-burdened with some type of reserve and consequently excessive investment costs.

#### Space Economy

This factor affects the investment cost of power and is especially of very great importance for plants of any appreciable size in large cities or where property is expensive. For different sizes of the various types of prime movers the number of kilowatts per square foot of floor space occupied, is from 10 to 15 for horizontal steam turbines, and from 0.5 to 0.8 kilowatt for gas and oil engines. Where a number of gas and oil engines are installed and the passage ways included, the contrast will be still greater.

#### Summary

Perhaps the most remarkable fact brought out in this

report is shown in Fig. 19, where we find that the large steam turbine has now passed the gas engine in thermal efficiency and the only prime mover surpassing it is the Diesel type of oil engine. The oil engine reaches a maximum efficiency of about 28 per cent as compared to about 24 per cent for the latest type of 20,000 kw. high-vacuum steam turbine, and there is every prospect that at least 26 per cent will be realized before the end of the current year.

The present limit in size of the Diesel type engine seems to be about 1,800 kw., so that for plants in excess of 15,000 kw. in capacity the number of units and the space occupied by them becomes excessive. Just what their maintenance under the high cylinder temperature will be is dubious, as there are not sufficient data available to enable the committee to report.

Figs. 16 and 17 summarize the whole prime mover situation in the combined curves of investment and fuel costs, as by taking the sum of the ordinates at any percentage of the rated load it will be seen that the steam turbine is far more economical than any other type of heat engine.

In conclusion the authors wish to acknowledge their indebtedness to Mr. D. W. Mead, a member of this committee, for the curves of Fig. 14 and a portion of the section on hydraulic turbines, and also the kindness of a number of manufacturing companies in furnishing the necessary data.

#### (Concluded from page 48)

the lines was made for operation at 100,000 volts and the operating voltage was only 20,000 and 40,000 volts, the results were quite different. Since the factor of safety of the insulators was about 10, they were not functioning as lightning arresters or protectors for the apparatus, and consequently every lightning stroke that appeared on the line came with horrible impetus into the station. Switch bushings, transformer bushings, and other insulation that had withstood the conditions of other circuits, immediately began to break down from flash-over or by puncture. Lightning arresters of the best type were then required.

This is a condition that is gradually growing all over the country. Everywhere operators find that insulation on the line is an important factor, and are increasing the factor of safety in the line insulators. Personally, I would never use a factor less than three times normal potential, preferably still higher. The extra investment in insulators is worth while. This ultimately necessary practise will increase the need of lightning arresters.

The lightning arrester in itself is not a surge protector, but an over-potential protector. The gap setting is 25 per cent. above normal operating voltage, and the arrester will operate as a surge protector only after the gap sparks and connects the aluminum cells directly to the line. I am somewhat disappointed that there has not been more adverse criticism, as our foreign friends are finding a great many things to say. I feel that any criticism or any failure of the aluminum arrester to protect the circuit can be explained by some weak local condition, or otherwise, the design of the arrester can be easily modified to meet new conditions. As Dr. Steinmetz has so well emphasized today, the great need at the present time is more definite information. A few years ago it was a very common thing to have bushings fail on transformers and switches, but today, due to the presence of the aluminum lightning arrester, these faults have almost entirely disappeared. Those that have not disappeared I hope to be able to give a reason for, at some not far distant time, as a result of the study of porcelain insulators at high frequencies. Porcelain insulators and bushings have a different strength at 60 cycles on which they are usually tested, from their strength at very high frequencies, such as 200,000 cycles per second—or its equivalent, expressed as steepness of wave front.



## Abstract of a Report of the Work of the Meter Committee of the N. E. L. A.

Mr. G. W. Magathaes.

The three principal subjects taken up by the Meter Committee for the past year have been: 1. Maximum Demand Indicators; 2. Standardization of Instrument Shunts; and 3. Legislation Affecting Meters.

### 1. Maximum Demands

The increasing popularity of demand rates has necessitated the development and production of demand indicators to give the maximum demand on customers' premises for billing purposes.

The first step was to send out to member companies a circular letter having the following questions:—

1. Are you interested at the present time in the development of maximum demand instruments or meters?
2. What general type of instrument would be considered satisfactory?

(a) Printing watt hour meter, leaving a paper tape record in the form of a reading of the meter at the end of each interval of time, similar to a printometer; or

(b) Graphic recording watt meter, leaving the record in the form of a continuous curve, similar to a curve drawing instrument or a graphometer; or

(c) Thermo type of ammeter, leaving the indication in a form similar to the Wright demand meter; or

(d) An integrating type, showing by means of an indicating hand the highest integrated load used during a definite interval of time, similar to the maxicator; or

(e) An integrating type, showing by means of an indicating hand the shortest interval during which a definite integrated load is used; or

(f) A circuit interrupting type, which automatically makes and breaks the circuit when a pre-determined demand is exceeded, usually used in place of a meter, and termed an interrupter or flat rate controller; or

(g) Suggestions for other types.

3. What time interval do you approve for the various classes of service? Enumerate classes and intervals and reason for each, if possible.

These questions elicited a great variety of answers (440 replies), indicating more than anything else the chaotic condition of the maximum demand question at the present. There were time intervals all the way from one minute to sixty minutes. There were advocates for and against every one of the existing instruments.

While these replies were coming in a general meeting had been arranged between the meter committees of the N. E. L. A. and the Edison Illuminating Association, and representatives of the various meter manufacturers were invited to attend and participate in the general discussion.

A general discussion took place on the question of time interval; the character of the record required, as to whether it should be graphic, or simply indicated.

The general sense of the meeting seemed to be that while the graphic instruments provided a full and complete record, there were many classes of service where an indicator, or record of one single demand would be sufficient.

This latter form of instrument was further considered as being available in the form of a separate instrument combined with the watt-hour meter, and further capable of being combined with the watt-hour meters already installed.

The degree of refinement in the record desired was also advanced as a suggestion for a modification of demand instruments, to the end that two or three forms of instru-

ments, varying in cost, be available for different classes of service.

It was felt that certain classes of service required a graphic instrument, which would give a detailed history of the load used; this would be for extra large "off-peak" power consumers. Small customers, either power or light, would require a demand indicator which would give simply an indication of the maximum demand for the month. These instruments need not be very elaborate, and should therefore be of comparatively low cost.

In this class in particular the apparatus should be such that it could be installed in connection with the integrating watt hour meter already in place.

There are also a number of intermediate classes of service, which require more than a simple indication of the maximum demand, but not the refinements which a graphic would supply. An example of such a service would be medium sized power customers, who had an "off-peak" contract.

The manufacturers appreciated the opportunity of a voice in the discussion, and stated that they would welcome any standardization on the question of demands; as in that case they would have something definite to work on, and they were sanguine of early developments of instruments to meet the requirements.

A number of the members of the meter committee undertook on behalf of their own companies to carry on tests on the various demand indicators available at present, connecting them up in series, and running simultaneous tests on the various types. There has hardly been time to obtain complete results on these tests.

A sub-committee, composed of members of each of the meter committees, was appointed to continue the investigation of demand meters, to draw up definitions covering the maximum demands, and also to present a classification of the various kinds of demand instruments at present on the market.

Several of the instruments now available have been turned over to the Electrical Testing Laboratories for investigation as to limits of accuracy.

### 2. Standardization of Instrument Shunts

This question was taken up together with the committee on electrical apparatus. These two committees sent out to the manufacturers the following letter:—

1. Do you have a uniform drop on all your instruments and meter shunts?
2. If not, what classifications do you use?
3. What is the drop for each classification?
4. Do you use a standard lead and meter terminal construction?
5. Will you please submit dimensioned drawings showing terminal construction?
6. Will you consider changing your practice if to conform to a standard?

As in the case of the demand instruments the two committees notified the manufacturers, and invited them to an open meeting, at which the question of standardization of the drop in shunts and in the terminal construction was discussed.

Thanks to the co-operation of the manufacturers the joint committees were able to make recommendations for two standard milli-volt drops on the shunts for three general classifications of instruments. It appeared to be too drastic a move to make one standard at the present time. The final recommendations by the joint committees follow:—

Classification:—

Class (a) Switchboard type shunts.

Class (b) Portable shunts.

Class (c) Integrating watt hour meter shunts.

The committee recommends:



(1) That each manufacturer adopt a standard milli-volt drop for their shunts of different classifications.

(2) That shunts manufactured for any standard milli-volt drop should be correct within one per cent.

(3) That the standard milli-volt drop should be stamped on both sides of one of the shunt terminals.

(4) That shunts under classification (c), for integrating watt hour meters, should be calibrated within 1 per cent. of the standard milli-volt drop adopted, and that on switchboard type shunts the true milli-volt drop should be stamped on both sides of one of the shunt terminals.

(5) That in view of the variation in present practice the committee adopt at this time standards of 50 and 60 milli-volt, with a recommendation that future committees endeavor to standardize a single value for switchboard shunts.

(6) That shunts under classification (b), for portable instruments, must be interchangeable, and the shunt and instrument as a whole must be within the limits of accuracy prescribed by the Code for electricity meters.

(7) That on portable type shunts the true milli-volt drop should be stamped at a prominent point on the shunt.

(8) That in view of the variation in present practice the committee adopt at this time standards of 100 and 200 milli-volts for portable shunts, with a recommendation that future committees endeavor to standardize a single value for this classification.

(9) That the shunt terminal should be made of such material as to have practically a zero temperature co-efficient, and no thermo-electric effect against copper, wherever possible.

(10) That the ordinary shunt leads should be so designed as to be interchangeable for any specific types of instruments.

(11) That the terminal construction of shunts should provide for the use of  $\frac{1}{4}$ -inch bus.

(12) That unless a shunt terminal is slotted, or is of such construction as to prevent movement of the bus, that it should be constructed with two bolt holes in each terminal in capacities of 500 amperes and up.

### 3. Public Utility Regulation

This embraces all legislation and regulation affecting meters.

\*Out of the nine provinces of Canada five have Public Service Commissions. Out of the 48 States 46 have Railway or Public Service Commissions, and nine have Commissions adopting or proposing standardization for electrical service.

During the past year there have come to the notice of the committee five new commissions, eleven commissions adopting new rules, and one case of state laws and municipal ordinances.

In some of these cases, where the meter committee have been notified, they have placed themselves at the service of the member companies affected by the proposed legislation or rulings; and together with the executives of the N. E. L. A., have taken up with the various commissions the question of the proposed legislation, and have been instrumental in moulding these rules.

They have been met, in all cases, with a cordial reception on the part of the commissions, who have welcomed the expert knowledge that could thus be brought to bear on the formation of new rulings.

\*Mr. Ormond Higman (head of the Government Meter Testing Bureau), stated in this connection that if the several provinces did have Public Service Commissions, nevertheless, meters came under the jurisdiction of only one body, namely the Bureau of Weights and Measures.

Canada and the United States were divided up among the various members of the committee; each member being detailed to get in touch with the various provincial or state

associations, and keep a look out for all proposed rulings or legislation.

In some of the states the state associations have meter committees, and the purpose of the N. E. L. A. meter committee member was, if possible, to become a member of these sectional meter committees.

An instance of the co-operation between the commissions and the meter committee arose when the Wisconsin Railroad Commissions were establishing new rules and regulations covering electrical service. Rule No. 28 covered the question of demand instruments, and required impracticable limits of accuracy. This was brought to their attention, and they laid that rule on the table, stating to the N. E. L. A. that this rule had been suspended for one year or until an investigation and report by the various utilities committees had been made; it being the opinion of the commission engineers that the matter could be adjusted within the year, or if not, further suspension could be requested.

Another matter which has been receiving the attention of the committee is that of ampere hour meters. The question has arisen of using the less expensive ampere hour meter instead of the watt hour meter, on d.c. systems where the voltage is practically constant.

A number of the members of the meter committee, on behalf of their companies, undertook to carry on tests on ampere hour meters in service.

These meters are installed in series with the ordinary watt-hour meters, and also with recording volt meters, so as to have a record of voltage fluctuations; these tests are to extend over a year, in order to give the ampere hour meter an exhaustive test under service conditions. There are, therefore, no results as yet from this work.

The committee also completed the work on standardization of instrument and meter diagrams, and has given some consideration and space to the accuracy of meters, to breakdown tests on induction meters, and to some additional data of the meterman's handbook.

## The Work of the Street Lighting Committee of the N. E. L. A.

Mr. Wills MacLachlan

The President and Managing Committee have asked me to bring to your notice in a short way some of the advantages that accrue to the Canadian Electrical Association, due to the privilege of the Canadian Electrical Association having a member on each standing committee of the National Electric Light Association. To do this I will outline the work of the Street Lighting Committee of the National Electric Light Association.

The question of street lighting has been taken up by committees of the National Electric Light Association since 1894, but it has been only within the last few years that it has been possible to expend a great deal of time and money on investigating the problems of street lighting due to the fact that other, possibly more important problems, were being investigated and were taking up all the time that was available.

Within the last few years valuable data has been collected, and the Street Lighting Committee has been trying to present to the National Electric Light Association information that would be of value to the engineers and managers of central stations in investigating their own street lighting problems. The committee of 1894 made a report and suggested that the arc lamps that consumed 450 watts should be rated as a 2,000 candle-power lamp. The committee of 1907 suggested that arc lamps on a spacing of from 200 to 600 feet should be rated at the intensity of direct illumination as measured 200 to 300 feet away from the lamp on a level street. The committees of 1911 and 1912 spent most of their time in investigating and collecting statistics with



regard to ornamental street lighting, advertising value of street lighting, etc. The 1913 committee went into the question of certain clauses in street lighting contracts, and made certain suggestions with regard to the important clauses in these contracts, and also presented the decisions from certain Public Service Commissions.

Taking the above into consideration, the committee that reported at the 1914 Convention in Philadelphia thought that the time was ripe to go into fuller investigations with regard to street lighting problems, as this question was becoming of a very important nature, due to the fact that traffic speeds were greater, and the congestion of traffic in large cities was becoming very serious, and also due to the fact that the public in general was becoming educated to a point where it demanded higher standards of illumination than were used in the past.

At the initial meeting of the 1914 Committee plans were prepared to carry on certain experimental work in street lighting, and four objects were set forth to obtain definite information upon:

- 1st.—Physical side of street lighting.
- 2nd.—Psychological side of street lighting.
- 3rd.—The economics of street lighting.
- 4th.—The ideal street lighting contract.

First taking up the physical side of street lighting. It was arranged to have two streets that converged at an angle equipped for about one-half a mile each with experimental systems of street lighting, one street to be equipped with small incandescent lamps mounted near the curbs. It was also arranged to have large incandescent lamps placed at regular intervals, but on a longer spacing than the small incandescent lamps. The other street is to be arranged so that it can be equipped with any type of illuminant that is on the market at the present time, and so that the spacing, height, etc., can be varied throughout the experiments, the object of the physical experiments being first, to obtain as ideal an illumination on the first mentioned street as possible and then use it as a comparison for comparing the other street as the illuminants were changed and as height and spacing was effected. After the tests were made it was the intention to take photometric readings and photographs in both streets after each experiment, and also it was arranged that the distribution curve of the different lamps used should be taken by ordinary laboratory methods.

At the very outset of the Committee's work, it was recognized that illumination has another phase besides the physical one, viz., the psychological. It was recognized that illumination must be judged from the effect that it has upon persons that are subjected to it, and the Committee, after investigating the good work, that was being done by applied psychologists in investigating the degree of fatigue and other mental processes in connection with telephone operators, motormen, etc., decided that it would be well to have the assistance of a psychologist in arranging a series of tests that were to be applied to observers in connection with the investigation. Professor Hugo Munsterberg, Professor of Psychology in Harvard University, was invited to confer with the Committee in this regard, and after meeting the Professor and having some of the phases of psychology with regard to illumination explained, the Committee felt that it had opened up a new side to illumination, and that any report that it should make that neglected the psychology of the situation would be entirely inadequate. Professor Munsterberg explained that investigation of illumination by psychologists was practically speaking an unknown field, and that he would have to consider the matter very seriously before suggesting tests, but he agreed to think the matter over, and make certain suggestions to the Committee. It was afterwards arranged that a young psychologist under the direction of Professor Munsterberg should have an active part in the carrying on of the tests, these tests to be applied

to private citizens, policemen, chauffeurs, and illumination experts.

At this point of the Committee's investigation it was thought advisable to obtain the advice and help of other bodies, who were deeply interested in the question of street lighting, and the Joint Street Lighting Committee was formed to consist of the Street Lighting Committee of the National Electric Light Association, the Street Lighting Committee of the Association of Edison Illuminating Companies and an advisory committee to be formed of illumination experts. At a general meeting of this committee it was recognized that any report on the question of street lighting would be very incomplete unless the question of economics was recognized and it was arranged that at the same time as the tests were being made that a Sub-Committee would be formed to carry on the work of obtaining data with regard to costs of construction, costs of maintenance, repairs and overhead expenses in connection with the different types of street lighting that were being investigated.

After looking over the work that was before the Committee it was thought that the data obtained would be very useful to any central station. The central station would have results of the physical tests of the illuminants, the results of the psychological tests of the illuminants and the economics of the situation, but it was felt that to round the situation out and to make it complete, that some definite suggestions with regard to the clauses of a street lighting contract should be incorporated. Mr. Morimer, the President of the North American Company, was approached on this subject, and as he had recently some considerable experience in drawing up street lighting contracts, he was asked to be the Chairman of a Sub-Committee that would draw up a standard form of contract. This Committee was then formed, and they have made very satisfactory progress in the work that they have in hand.

#### Thoroughness of the Work

The above will give in a short way an idea of the thoroughness with which the Committees of the N. E. L. A. go into any matter that they take up, and it is the privilege of the Canadian Electrical Association to appoint one member on each of the standing committees of the N. E. L. A. It was my privilege during the past year to represent you on the Street Lighting, and it is certainly a distinct advantage for any man to work on the Committee with such men as constitute the N. E. L. A. Committee. These men represent the most up-to-date forms of practice in central station work.

The standing committees of the N. E. L. A. are from year to year bringing out reports that might be considered as classics in regard to central station practice. I need not mention the reports of the Meter Committee, the reports of the Overhead Lines Committee and the reports of the Publication Committee of the Commercial Section, and after next year we hope that the Street Lighting Committee will have marked a milestone in the advance of illuminating engineering in connection with street lighting. The advantage to the company and to the officers of the company that are represented on these committees, as shown above, may well be realized, but the real benefit will eventually come to the public, who will receive better service than they have received in the past, and although I realize that the question of rates is a very important one, yet I think that the public is realizing that service and continuity of service is the big question in the supply of electricity, and the company that gains the benefit of the consensus of opinion of the foremost men in the industry, and who has its officials in close touch with these men by being on the committees of the National Electric Light Association, will be able to give to the public better service in every branch of central station work, and will become a real public service corporation, having for its motto an adaptation of the motto of the Prince of Wales "Ich dien" making it "We serve."



# Electric Railways

## Cost of Installing Bonds

In the choice of bonds too much stress is sometimes laid on the first cost, as when it comes to installation and maintenance certain types are much more to be desired than others. Quite often the added expenditure incurred in these two factors more than offsets the difference in first cost. The Electric Railway Journal prints some interesting figures submitted by Mr. C. H. Fuller, Engineer of Maintenance and Way of the Macon Railway & Light Company. This writer does not favor very short and rigid forms of bond, as in most cases the track where not laid in the concrete base of paving is subject to considerable vibration of the joint resulting in the mechanical destruction of the bond. On the road mentioned three types of bond have been adopted as best meeting the requirements, namely (a) a concealed, stranded, compressed terminal type used under the splice plates, 7-in. to 9-in. in length, depending on the bolt spacing; (b) a stranded long bond, 24 to 36 in. in length, with compressed terminals, to be used around the plates, and (c) a pin-compressed terminal bond of about the same description as (b) to be used where rail is too small to admit of good work with the compress or for single replacements to be made by the track crew when it is not convenient to send for the bond crew. This company have been using these types of bond during the last two years and the writer states that no single case of failure due to mechanical conditions has been brought to his attention. In the cost figures which follow a crew usually consists of one man to run the drill (a Duntley electric track drill) and a helper who assisted in moving the drill and pressed in the bond. Both men removed and bolted up the plates as occasion required. The wage of the drill runner was \$1.50 and of the helper \$1.35 per day of ten hours.

Case 1. Paving job. Track laid and surfaced, with two bolts in each splice. Bond crew removed the plates, drilled two holes, applied the concealed bond with a screw press and full-bolted the joint: 174 bonds at \$0.2625 per bond.

Case 2. Installation of a crossover in Belgian block paving. Bond crew drilled the holes, applied the concealed or long bond as required, full-bolted the joints: thirty-five bonds at \$0.266 per bond.

Case 3. Repaving job. Old plates and bonds were not disturbed. Twenty-eight inch bonds with compressed terminals were placed around the old plates. Bonding crew had a good chance to do record work and placed 128 bonds at \$0.175 per bond.

Case 4. Paving job. Bond crew removed two bolts and plates, drilled for and placed concealed bond, replaced the plates with two bolts loose for track gang to finish; 199 bonds at \$0.1825 per bond.

Case 5. Paving job. Bonding crew applied concealed bonds while track gang was laying track, but made no special effort to full-bolt the joints: eighty-five bonds at \$0.168 per bond.

Case 6. Paving Job. Track all surfaced, double track, bond crew following all four rails as they came to the joints,

rails 60 ft. long, special effort to get low bonding costs, track gang applying the splice plates: 269 bonds at \$0.09 per joint. This was an exceptional case and the same crew has never been able to break its own record.

Case 7. Laying track in dirt roads. Bond crew applied pin-compressed terminal bonds under the plates, doing the bolting up: 113 bonds at \$0.136 per bond.

Case 8. Paving job. Remove plates with two bolts, drill two holes, compress bond and replace plates with four bolts, continuous work: 187 bonds at \$0.235 per bond.

Case 9. Paving job. Remove plates, drill holes with hand drill, compress bond, replace the plates: eighty-three bonds at \$0.375 per bond.

Case 10. Track laid in dirt road and fully surfaced. Remove plates with four bolts, drill holes and compress bond, replacing the plates. The four men in the crew worked continuously: 1020 bonds at \$0.2405 per bond.

Case 11. Remove plates having four bolts, drill and press in bond, replacing plates: fifty-four bonds at \$0.292 per bond.

The following is a six months' record of bond replacements, the work being scattered into installations of a few bonds here and there. In all cases the cost includes the breaking out of old bolts, removing old plates and old bonds, reaming or drilling new holes and rebolting plates and the time lost moving about. The work usually was done in the intervals between construction jobs and other labor.

First month	85 bonds at \$0.285
Second month	42 bonds at 0.31
Third month	54 bonds at 0.295
Fourth month	37 bonds at 0.35
Fifth month	94 bonds at 0.325
Sixth month	21 bonds at 0.36
Total	333 bonds at *0.313

\*Average cost per bond.

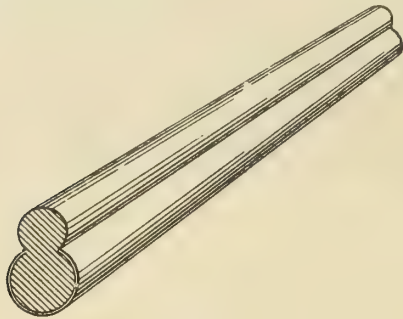
## Low Resistance Conductor

Mr. Louis Steinberger, president of the Electrore Manufacturing Company, has just secured a patent on what is termed a flexible electric conductor which is adapted for general use, but more particularly to conductors for trolley and catenary overhead line construction for purposes of electric traction. The body of the wire is made of two portions (in outline like the figure eight) integral with each other and each having a nearly cylindrical form, one portion being of greater diameter, however, than the other. This body portion is preferably made of steel or tough iron and has great tensile strength. To the larger portion of this wire a ribbon of copper is applied as shown in the illustration. This is accomplished by pressing up the edges of the copper ribbon so that they are closed firmly into the channels in the body of the wire at the junction between the upper and lower portions.

It is claimed that the ohmic resistance of this flexible electric conductor is very small; this is particularly the case if the parts be of large size. The conductor is suitable for



either d.c. or a.c. currents, but for the latter it has a peculiar advantage owing to the fact that the copper ribbon is so disposed as to take advantage of the so-called "skin effect" which follows from the well-known fact that a.c. currents of high frequency follow the outside rather than the inside of a

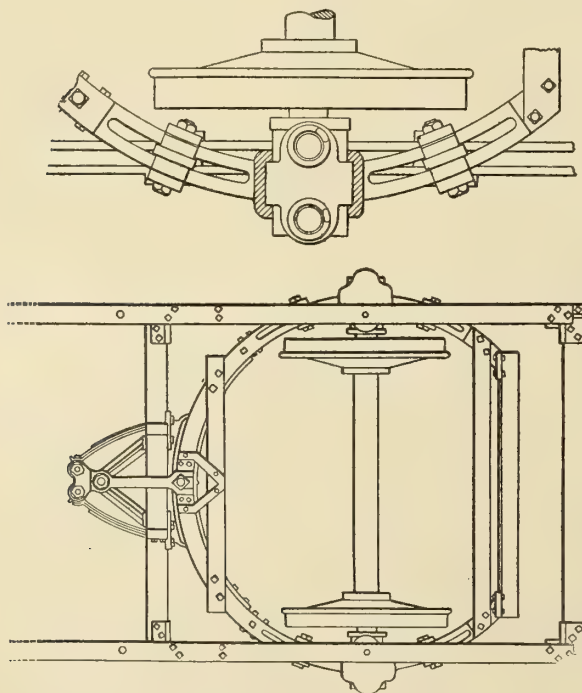


New trolley wire.

conductor body. It follows that if the outside conductor be of copper or other low resistance material the conductivity of the whole is greatly increased.

### Radial Axle Single Truck Cars

Mr. Fred Steffens, master mechanic of the St. Josephs Railway, Light, Heat & Power Company describes in the Electric Railway Journal a patent he has recently secured on a radial axle long wheel base truck, the construction of which is illustrated in part in the accompanying diagrams. Interest in radial axle single truck cars has been revived by the recent purchase for the Third Avenue Railway System of New York of a total of fifty single truck cars with radial axle trucks. These operate with perfect satisfaction on a 35-foot car body, a size which is ample for most companies operating in towns or suburban city districts. The following



Section of one end of radial axle truck.—Upper figure shows detail of roller mechanism at journal box.

paragraphs are taken from Mr. Steffens' description of his new patent.

This truck made its first trial trip on April 30, when it was taken over all the worst tracks and curves in St. Joseph. Although the truck was new and rigid it did not refuse to go over any of our tracks. It entered regular service under

car No. 12 on May 1 and has been in service ever since. The truck frame is 22 ft. 5 in. long over all. The wheelbase is 15 ft., which the writer believes is the longest ever built to run under a car successfully. This wheelbase was used because the car would not take a longer truck; otherwise the writer would have built the truck with a 16-ft. or 18-ft. wheelbase, as his design is adapted for lengths as great as 25 ft.

Car No. 12 is 22 ft. 8 in. over the corner posts, and 36 ft. 9 in. over the bumpers. Previously it was mounted on an 8-ft. wheelbase Dupont truck, where the overhang and the oscillation were so great and the swing was so heavy when it entered a curve that very unsatisfactory service followed. The use of a radial axle truck makes it ride as steadily as a double-truck car.

This truck is equipped with a curved horizontal frame which nearly encircles each axle, as shown in the drawings. At the intersection of this curved frame and the normal position of the axle, the frame carries an inverted "U" member which can slide vertically outside and above the adjacent journal box. On each side of the journal box the curved frame is provided with concave runways on which rollers are mounted. Normally these rollers rest in the lowest portions of the runways, but when the trucks turn a curve they run up the runway for a distance proportional to the degree of curvature. Gravity tends to return the rollers to the lowest positions when the trucks return to straight track.

However, to assure the prompt return of the axles to their proper position each truck has a supplemental spring-actuated mechanism of the character shown in the plan view. It will be seen that the middle point of the circular frame carries a lever which is pivoted on a vertical pin. At the other end of this lever are two mounted friction rollers against which two leaf springs bear. These springs are secured to an angle bar and press toward each other, thereby resisting the movement of the lever from the central position. After the car wheels have turned a curve and are on a straight track the springs assist the hanger rollers to return the axle and car wheels to their proper position. In going up or down grades the leaf springs insure the proper positioning of the axle relative to the frame in case the runway rollers alone do not effect this function.

While in this particular truck the car body supporting frame connects the two pairs of wheels, it will be readily seen that each pair of wheels is in a frame by themselves. They could be separated by leaving out the centre top and bottom plates, and continue to work just as well if not better in case a wheelbase longer than 14 feet is used. The radial truck should supersede all other single or double trucks for two-motor equipments, for since it permits the weight of the motors to be carried on two axles instead of four it gives better propelling power and therefore less skidding, spinning and energy consumption.

The Edmonton Interurban Railway Company will resume operations, with an hourly service, between Edmonton and St. Albert on the first of October. They are at present electrifying the road under the supervision of Mr. W. T. Woodroffe, formerly superintendent of the Edmonton Municipal Railway System. It is understood also that negotiations are being carried on between the company and the Edmonton municipality whereby the latter will supply electric energy for the operation of the road. It is stated that the company will erect a car barn and work shops at St. Albert.

September 21st has been set as the date on which municipalities will vote on the question of closing contracts with the Hydro-electric Power Commission of Ontario to build an electric road through the Newmarket, Port Perry and Uxbridge district.



# The Dealer and Contractor

## Code of Ethics

The National Electrical Contractors Association at their recent convention adopted a code of ethics for the general guidance of the members of the association. In presenting this code it was pointed out by the committee who had the matter in charge that a code of ethics according to their understanding was simply a declaration and not a set of laws which could be incorporated in the constitution or by-laws. Law does not inculcate in men the principles of honesty and fair dealing and this code, it is pointed out, was not intended to be construed as applying to men who have not an inborn tendency toward the Golden Rule. The committee, in the preparation of this code, have adopted the position that members seek to join or retain their membership in any organization because of their desire for mutual helpfulness. The code of ethics reproduced below indicates that the members of the National Electrical Contractors' Association consider themselves a profession rather than a class. The principles defined herein would do justice to their country's oldest and most honorable organizations.

Section 1. Members of the Association shall regard themselves as being engaged in a business in which there is a well defined duty and obligation towards the public and themselves. The business demands that members use every honorable means to uphold the dignity and honor of this vocation, to exalt its standards and to extend its spirit of usefulness.

Section 2. Every member of this Association should be mindful of the public welfare and should participate in those movements for public betterment in which his special training and experience qualify him to act. He should not even under his client's instruction, engage in or encourage any practices contrary to the Rules and Regulations Safeguarding Life and Property, for as he is not obliged to accept a given piece of work, he cannot, by urging that he has followed his client's instruction, escape the condemnation attaching to his act. Every member of this Association should support all public officials and others who have charge of enforcing safe regulations in the rightful performance of their duty. He should carefully comply with all the laws and regulations touching his vocation, and if any such appear to him unwise or unfair, he should endeavor to have them altered.

Section 3. It is unprofessional for a member of this Association to assist unqualified persons to evade or to lend himself in the evasion of any of the recognized rules and regulations governing electrical work.

Section 4. Members of this Association should expose, without fear or favor, corrupt or dishonest conduct and practices of the members of their business, and it is their duty to bring to the attention of the proper authorities the existence of electrical conditions which are unsafe to life and property.

Section 5. Members of this Association owe a duty to the business of refusing to furnish estimates to general con-

tractors who do not regard bids as final and binding upon which they are awarded general contracts.

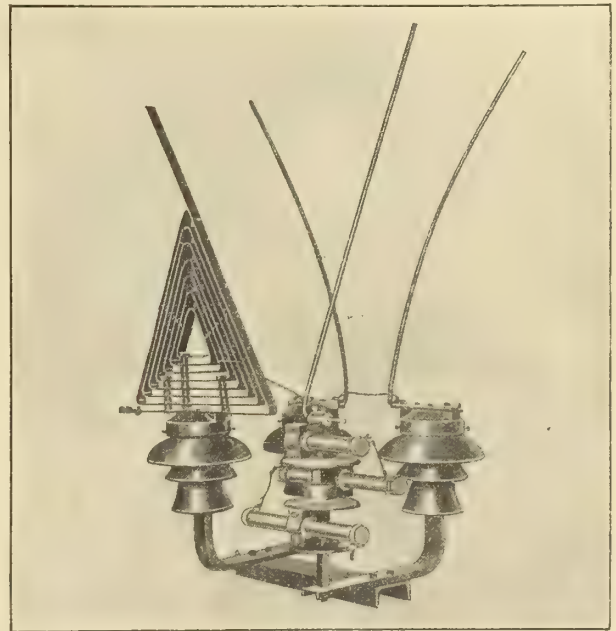
Section 6. Members of this Association shall not falsely or maliciously injure, directly or indirectly, the business reputation, prospects or business of a fellow member of this Association.

Section 7. Members of this Association shall not attempt to supplant a fellow member after definite steps have been taken toward his employment or toward the letting of a contract to him. Nor should they offer any interference in the carrying out of said contract or commission to the end that loss or damage may result to the fellow member.

Section 8. Whenever disputes or differences arise between members, it should be the duty of the party to the controversy to submit the trouble to an arbitration of two disinterested members of this Association and in the event of a failure to arrive at a satisfactory settlement, then upon request, the President of the National Association shall appoint a third member of the Commission and the decision of the majority of said Commission shall be final and binding.

## Horn-gap Arresters

To meet the demand for a lightning arrester embodying all the characteristics of the Burke series horn-gap arrester, but with a resistance in the ground circuit of each phase, the Railway and Industrial Engineering Company, Pittsburgh, have placed on the market the protective equipment illus-



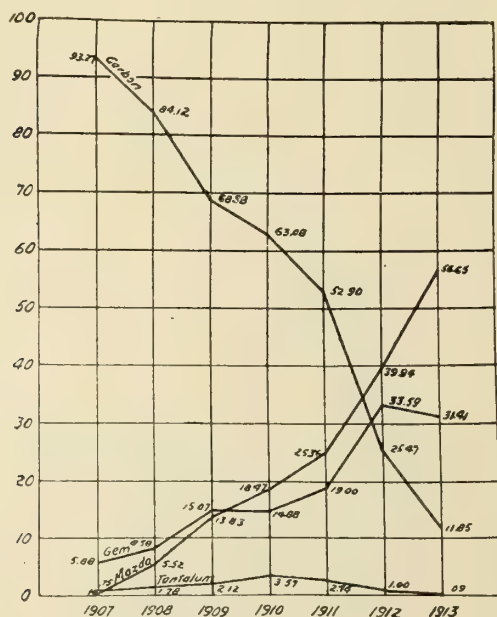
trated. The arrester consists principally of a triangular choke coil wound with strap copper and a ground horn mounted on a special post type insulator, which supports and insulates from each other and the ground the resistance units. In the design of the arrester, the two factors which



cause a surge to arc the ground are concentrated at one point. That is, an efficient obstruction in the form of the triangular choke coil, and a point of weak resistance to ground in the form of the horn gap. A surge meets its first obstruction at the first sharp turn of the choke coil, opposite which point is mounted the ground horn. Due to this construction the gap to ground may be set fifty per cent. greater than the ordinary shunted horn gap and the same protection be obtained. The resistance is of such ohmic value as to limit the flow of dynamic current to approximately ten amperes, should two or more phases discharge simultaneously. It is inserted in the ground circuit of each phase, and is composed of koppat. This resistance material is extremely strong mechanically and possesses electrical characteristics which make it particularly adaptable to this service. It has a very low positive temperature coefficient to resistance, conducts current uniformly throughout its entire mass, and is not affected by high frequency discharges, as are many other composition resistances. These resistance columns are so constructed that they may be used in connection with Burke arresters now in service, operating with horns connected direct to ground.

### Incandescent Lamp Manufacture

An interesting set of curves showing the number of incandescent lamps of each type, in percentage, manufactured during the past seven years is published by Mr. G. F. Morrison, manager of the Edison Lamp Works of the G. E. Company in the last issue of the General Electric Review. Mr. Morrison states that the number of domestic incandescent lamps, exclusive of miniature lamps, sold during 1913 was slightly in excess of 100,000,000, an increase of 59 per cent in seven years. The curves show that during this period the tantalum lamp has practically gone out of existence having represented in 1910 some  $3\frac{1}{2}$  per cent of the total number of sales. During the same period the carbon lamp which in 1907 represented nearly 94 per cent of the total of



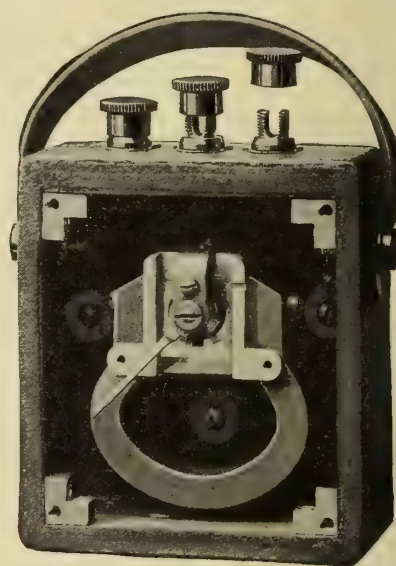
incandescent lamps in use now represents only a little over 11 per cent. On the other hand the Gem and the Mazda types have increased in popularity from 5 per cent, and 1 per cent respectively to 31 per cent and 56 per cent. During 1913 the increase of the Mazda lamp business was approximately 60 per cent, the total sales of this type exceeding that of all other lamps combined. It is further noted that the 25 watt lamp embraces 29 per cent of the total Mazda lamp business, the 40 watt 27 per cent and the 60 watt 15 per

cent. In street series lamps the 60 candle-power is the most popular.

Referring to the importance of carefully selecting lamps of proper voltage Mr. Morrison states that the ability of the manufacturer to turn out lamps accurately to a predetermined voltage and efficiency makes the introduction of lamps of the proper size and correct voltage on the lines on which they are to be operated especially necessary. There is no economy, but on the other hand there is an actual loss to the consumer and to the central station in operating lamps at a voltage below that for which they are manufactured. The total cost of a given amount of light is greater at any efficiency poorer than that of the manufacturer's rating.

### New Direct-Current Portable Meters

A new line of 5 inch diameter direct-current portable ammeters, voltmeters and millivolt meters, known as the type PW, has just been placed on the market by the Westinghouse Company. These instruments are direct reading



and suitable for battery testing, signal work, and all purposes where an instrument of pocket size is desirable. They are particularly adapted to testing electric lighting and starting equipments of automobiles. They operate on the D'Arsenal principle, having a moving coil and a permanent magnet, which renders them free from residual errors. The complete movement is mounted as a unit. A unique feature is the arrangement of the moving element which can be readily removed by taking off the cover and removing the two screws on the side pole-piece support. The entire moving element and the bearings can then be lifted out as a unit and can be replaced in exact position. This makes repairing possible without disturbing the alignment of the magnetic circuit.

### A Large Contract

A large contract has recently been placed with the Northern Electric Company for the supply and installation of all the necessary cable and cable accessories in connection with the Cedars Rapids Manufacturing & Power Company's new plant at Cedars, Que. The order calls for approximately 220,000 feet of cable, divided up into 90,000 feet of paper insulated, lead sheathed, 124,000 feet of rubber covered, 3,000 feet of varnished cambric and 3,000 feet of bare stranded conductor.

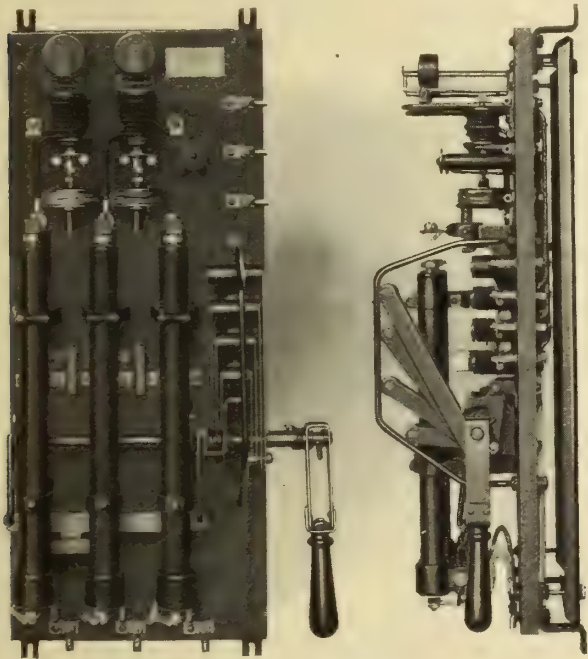
The paper insulated cables are made with single, triple and quadruple conductor cores varying in size from No. 6



B. & S. to 1,250,000 c.m. and in voltage from 660 to 13,200, the largest part of this item being 54,000 feet of 300,000 c.m. 3-core, 13,200 volt cable running between their generating station and transformer building. The rubber covered cables vary in size from No. 10 B. & S. to No. 4/0 B. & S. and in voltage from 660 to 4,400, the larger part of this item being 86,000 feet of multi-core remote control cables made with two to eight conductor cores. The small item of varnished cambric and bare stranded conductor will be used in making miscellaneous connections in the power house. Over two hundred potheads of different sizes and types will be used in protecting and terminating the ends of the paper power cables.

#### Carbon Compression Type Resistance Starters

The Allen-Bradley Type H resistance starters illustrated herewith, made in sizes up to 100 horse-power, provide for no-voltage and overload protection for induction motors. They are claimed to be the result of a careful study of the requirements of the apparatus for this service, in while the design has been further benefitted by experience gained in the manufacture of previous alternating current devices, each of which contained some, but not all of the features incorporated in the present machine. The starters embody the carbon compression resistance units, which during many years of service are claimed to have demonstrated their superior efficiency over other forms of resistance. The



wire wound or grid type resister at times causes considerable trouble and exasperating delays, due to the fact that it becomes corroded and eventually burns out, which is not possible with the carbon compression resistance. The latter also gives the motor a more even and smooth start, as the resistance is not cut out spasmodically but is changed gradually with the increase of pressure applied to the resistance column. One of these units is supplied for each individual phase. The pressure applied to the tubes at any instant is the same, which is brought about by an equalizing mechanism, so that the phases are always entirely balanced.

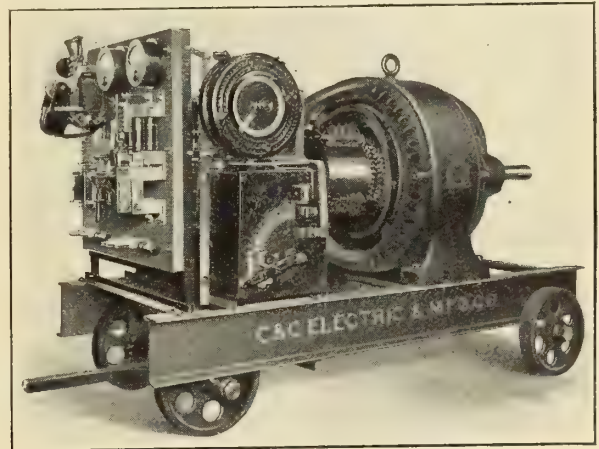
#### Have Opened Lighting Division

The H. W. Johns-Manville Company announce that owing to the rapid growth of their lighting fixture business they have established a new division of their electrical department to be known as the Lighting Division. This new

division will enable the company to enlarge the scope of their business and service in lighting fixtures by the addition of many new lines. The new division will be prepared to furnish, from stock, designs in brackets, pendants, hangers, ceiling fixtures, glassware, etc., to meet practically every requirement. The company will also be equipped to undertake special fixture work.

#### Portable Arc Welder

A new portable arc welder, having all the features of the larger stationary equipments has been designed by the C. & C. Electric & Manufacturing Company, of Garwood, N.J. The equipment is extremely flexible for welding and repair work in ship yards, machine shops, locomotive shops and foundries. The motor circuit can be connected to any available part of the shop or yard circuit. The apparatus, consisting of dynamotor, control apparatus and switchboard are supported on a base of I-beams and mounted on a heavy iron truck on wheels. The welding current is generated by a 110 volt dynamotor, the generator end having a capacity of 200 amperes at 70 volts. The motor shaft is extended



for receiving a pulley for belt drive by gas, oil or steam engine when in use on barges, shop yards or where current is not available.

As illustrated, the starting box and field control rheostat are mounted on the frame structure supporting the switchboard. The switchboard carries main line switch and circuit breaker for the motor, and automatic control relays for two individual welding circuits. A set of four hundred amperes will provide for one graphite electrode or two metallic electrodes for welding. The graphite electrode gives a temperature of about 4000 deg. C. and is used for cutting, pre-heating and welding with auxiliary bar. The metallic electrode for welding furnishes the welding metal directly and can be used on vertical or overhead work. The automatic relays in each welding circuit, insert and cut out small steadying resistances on drawing the arc and thereby prevent burning of the metal. Automatic devices also prevent interference between operators. An ammeter in the welding circuits permits the accurate adjustment of the current to the work.

#### Trade Inquiry

Name and address of Inquirer may be obtained on application to the Electrical News.

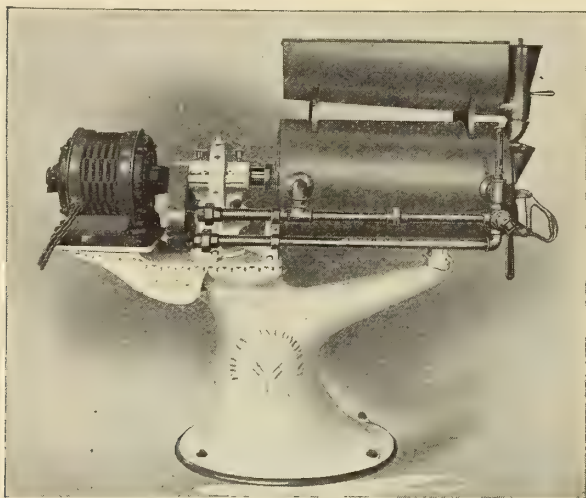
751. **Electric machinery.**—Canadian manufacturers are invited to correspond with Havana commission merchant.

The Canadian Westinghouse Company have opened an office in Edmonton, Alta., at No. 50 McDougall Avenue. Mr. G. D. Powis is the company's representative.



### An Individual Motor-Driven Ice Cream Freezer

The individual motor-driven ice cream freezer is now generally recognized as the most economical and sanitary type. By doing away with all belts and countershafts on a battery of freezers, a great deal of power is saved that would otherwise be used in turning idle shafting, and much greater cleanliness and safety is secured. The freezer illustrated is made by the Tyson Company, Canton, Ohio, and represents a most modern type. The freezing is effected by brine which flows around the freezing cylinder and is circulated by means of a small pump. Extensive tests show that a given quantity of ice can produce a greater freezing



effect when used as brine than when employed as ice in the tub type freezer. All parts touched by the cream are of non-corrosive metal and can be easily cleaned. The rear end is insulated by a dead air space. In front, a device is employed to show the consistency and "expansion" of the cream; a small quantity constantly flows out of the freezer into the half-funnel, plainly seen on the illustration, and back into the freezer. The operator, therefore, knows the conditions of his mix at any moment and can stop the freezing at the proper time, thus obtaining uniformity and preventing waste of brine by over freezing. The freezer shown has a capacity of 40 quarts and can freeze 500 gallons a day. It is driven by a Westinghouse Electric 2 horsepower alternating current motor.

### Fire alarm installation in Pembroke

The town of Pembroke can now boast one of the most up-to-date fire alarm installations in Canada. The equipment consists of the following:—

- 1—2 storage battery switchboard.
- 1—storage battery rack 60-in. double, white wood.
- 50—cells, BT storage battery.
- 1—motor-generator set, 110 volt, 60 cycle, direct to  $\frac{3}{4}$  kw., d.c. generator.
- 1—12-in. Excelsior gong.
- 1—Tower bell striker No. 5, not including bell.
- 1—6-in. Turtle gong in firemen's house.
- 22—plain Excelsior fire alarm boxes.

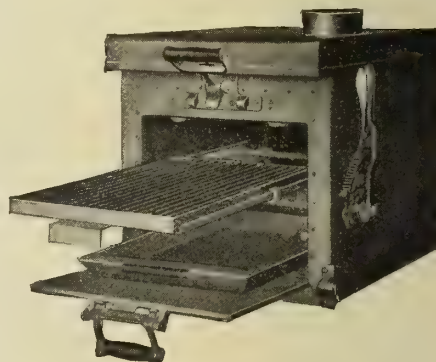
In addition, orders for eight private boxes were received from the following:—Pembroke Lumber Company, 2; Colonial Lumber Company, 2; Shook Mills, Pembroke, 1; Steel Equipment Company, 1; C. P. R., 1; Lee Mfg. Company, 1; and the corporation later purchased a 12-in. gong and indicator combined and two 6-in. electro-mechanical gongs.

It is encouraging to note that this town did not attempt to cut down the initial expense by installing a gravity bat-

tery system. It is generally recognized that while a gravity battery system is somewhat cheaper to install than a storage battery system is, the annual up-keep of the gravity battery system compared with the storage battery equipment will eat whatever money is saved on the initial installation within four or five years. Many of the small town systems which have been installed in Canada previously have used gravity batteries and later on found that it was more economical for them to use storage batteries. This, of course, meant a big additional expense not only in the cost of operating the gravity type of battery, but further in the necessary expense incurred by changing the type of battery. Equipment for this installation was supplied by the Northern Electric Company.

### Hotel Radiant Broiler

Just as electricity is used more and more every day in almost every industry, so it is becoming more popular in the hotel. It means efficiency in the kitchen, because it is quicker, cleaner, safer and more convenient. The C. G. E. hotel type broiler shown herewith has about 280 inches of broiler surface—a capacity of about 70 lbs. of meat per hour. The quality and uniformity of the broiled meat are unsurpassed by any other method of broiling. The Radiant heating unit, located at the top of the broiler, is easily and simply controlled. The grid on which the meat rests is supported on a movable frame, which can be raised or lowered at will. The gridiron can also be drawn out for turning or removing the meat. A removable drip pan rests on the bottom of the broiler chamber.



Consisting of sheet metal and angle iron—all walls thoroughly heat insulated—it should last a life-time. The heating unit is divided into two windings; the main winding consuming about 4,500 watts only when actually broiling and the auxiliary winding consuming 500 watts and used for keeping the broiler hot between broiler operations. Considering the speed and uniformity of the broiling, the operating cost is claimed to be very reasonable.

The next meeting of the Electrical Supply Jobbers' Association of America will be held at the Clifton Hotel, Niagara Falls, Ont., September 9, 10 and 11.

The Naugle Pole & Tie Company announce that they have opened an eastern office at 21 South High Street, Columbus, Ohio. The new office is in charge of Mr. L. E. Morier, who has been with the company in different capacities for the past nine years.

The Canadian Westinghouse Company have opened an office in the Telfer Building, 203 Hardisty Street, Fort William, Ont., so as to better take care of their increasing business in the northwestern portion of the province. Mr. B. James will have charge of the Fort William office,



### Another Needless Fire

It is said that the fire which recently destroyed some forty-eight cottages in Grimsby Beach, Ont., was caused by the use, in one of them, of a small coal oil stove, for ironing purposes. In these days when "Safety First" and "Conservation" play such a prominent part in our daily life the use of eighteenth century methods by one individual should not be allowed to jeopardize the lives and property of forty-seven. Electric current and equipment for ironing are available in Grimsby, both at reasonable cost. Were the cost many times as great it would have been less expensive in this instance than the coal oil stove.

### Reverse Current Relay

The Condit Electrical Manufacturing Company of Boston have developed a reverse current relay designed for transformer protection in installations where transformer banks are operated in parallel. These relays are designed for service where it is desired to open the alternating current circuits when the direction of current flow is reversed. A circuit breaker with shunt trip coils is required, the relay making connection to the trip coil to open the breaker, the specific purpose being to instantly cut out that particular bank of transformers wherein a fault may occur, without the interruption or discontinuity of the remainder of the system. The relay will operate equally well on all transformer connections; that is to say, on delta-delta or star-star, or delta-star, as the case may be. The relay consists of two powerful electromagnets which either close or maintain the tripping circuit open. Upon a reversal of current the relay is adjusted to operate and permit the tripping circuit to be

when there is a relative reversal of current in primary and secondary of the power transformers. The action of the relay is as follows: Assume the direction of the flow current to be as indicated by the arrows in Fig. 1. Under normal load conditions, the flow of current from C to D has no effect upon the relay except to keep the contacts of the shunt trip circuit open. However, should a fault occur, say, at the point O, the tendency would be for the current to now flow in the direction A, B, D, O, causing a reversal of current in a section of the feeder, D, O. This likewise produces a reversal of current in the current transformer and

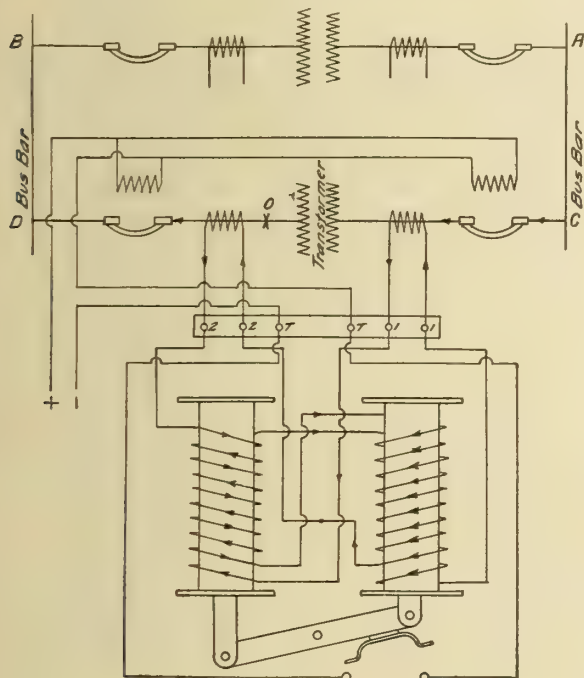


Fig. 1.

closed, resulting in a simultaneous opening of the circuit breakers on both the primary as well as the secondary sides of the transformer bank.

Fig. 1, the wiring diagram, illustrates the electric circuits of the relay, and, as indicated, instead of tripping the breakers mechanically, it closes a contact which allows current to pass through the shunt trip coils of the breakers, thus permitting them to open. Its operation is independent of overloads or short circuits, current transformer characteristics, potential, direction of energy flow and only operates

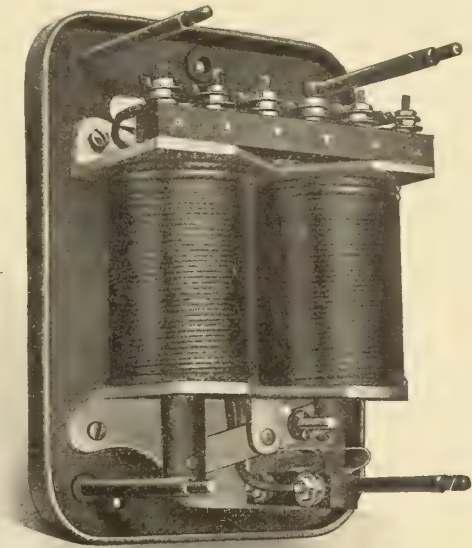


Fig. 2. Internal View.

causes the relay to operate and close the shunt trip coils of the circuit breakers. The circuit breakers both opening simultaneously, completely isolate the faulty bank of transformers, and the continuity of the entire system is not interrupted.

Fig. 2 illustrates the simplicity of construction of the reverse current relay. It is designed with few moving parts, well insulated, is so arranged that it will operate on a reversal of 2 amperes of secondary current, and requires but 20 volt amperes for its operation. The relay is enclosed in a dustproof case, suitable for installation on a switchboard, and has a black oxidized finish. The dimensions of the relay are: width, 6 in.; height, 8 in.; depth 4 in.

### New Companies

The Peace Valley Light & Power Company, Limited, has been incorporated with capital \$50,000 and head office Peace River Crossing, Alta.

The Southern Electric Light & Power Company has been incorporated with head office Montreal, and capital \$500,000. It is stated to be the intention to operate in the counties of Nicolet, Lotbiniere, Arthabasca, Yamaska, Drummond, Richelieu and Megantic.

The Canadian Electrical Association are taking steps towards co-operation in the placing of joint orders for electrical supplies. It is felt by most of the member companies that benefit will accrue not only to the purchasing company but also to the man on the street who buys electrical utilities and supplies from the organization which furnishes him with light and power. Further advantages in standardization of appliances are hoped for, resulting from a large number of companies placing orders for identical equipment.

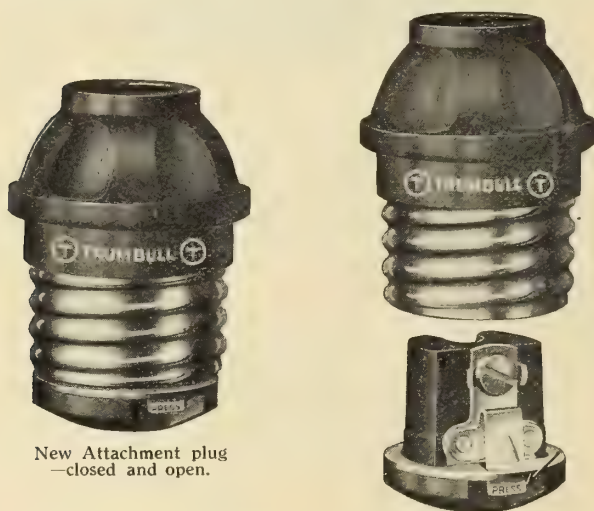


### Rectifier Bulb Life

Some excellent reports have been received recently on the life of mercury rectifier bulbs used on constant-current arc lighting circuits. These bulbs are guaranteed for an average life of 500 hours, but this guarantee is being generally exceeded, and in some instances an average life as high as from eight to fifteen times the guarantee has been obtained. A report of the Peoples Gas and Electric Company of Savanna, Illinois, recently issued, is an excellent example of what results are often obtained with but a slight attention on the part of the operators. This report showed an average bulb life for the last three years of 8,398 hours. It should be noted that this life is not the individual life of bulbs but the average life, for some bulbs still in service, are operating in the neighborhood of 9,000 hours. Mr. T. P. Bowen, manager of this plant, attributes this extra long average life to the fact that the bulbs are, as per instructions of the manufacturer, operated on short circuit for four or five minutes each night before throwing on the lamps. In addition to this treatment, the bulbs are occasionally taken from the tank and "rested" for a week or more and are also given an occasional hot water bath.

### New Attachment Plug

The Trumbull Electric Manufacturing Company are placing on the market a new swivel attachment plug as shown in the accompanying illustrations. Claims made for this plug are that it is easy to wire, roomy, constructed of



New Attachment plug  
—closed and open.

fireproof material and the easiest to open on the market. By pressing down on the catch shown the bottom drops out and the plug is open.

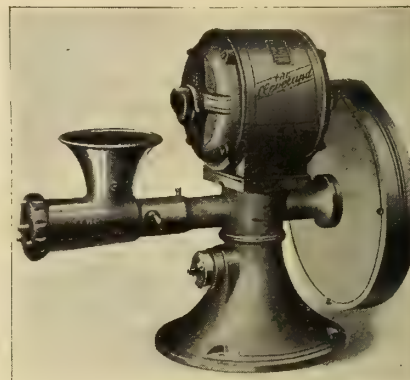
The Ferranti Electrical Company of Canada announce that they are in receipt of a large stock of standard meters from the Bruce Peebles Company which shipment arrived only a day or two before war was declared between England and Germany. In this respect the Ferranti Company consider themselves specially favoured in that they will be able to look after the needs of their customers and make shipments without delay until such time, in all probability, as the present situation is adjusted. The order includes as well a large stock of single and three-phase pole type transformers which came to hand by the same shipment.

As our readers have probably been made aware the Ferranti meter has been built in Toronto for several months past. By this arrangement the utmost flexibility has been obtained as, with a smaller total expenditure, a stock of the parts necessary for building up a large number of these meters of practically any standard size and type is always

on hand. Their present stock of parts is sufficient to make up some 8,000 meters. Whether as a result of their own foresight or of a piece of good luck, or a combination of these, the Ferranti Company should be congratulated in finding themselves in such a fortunate position at the present critical period in our industrial supply conditions.

### Motor-Driven Meat Chopper

A noteworthy feature of the motor-driven meat chopper shown in the accompanying illustration is its extreme simplicity. It forms an exceedingly compact unit, with all working parts totally enclosed so that it is perfectly safe and is



readily kept clean. Finished in red and aluminum bronze it forms an ornamental addition to any butcher shop. The height is 23 inches, width 16 inches, length 28 inches, and weight 240 lbs. With a  $\frac{1}{2}$  h.p. motor, its capacity is 350 lbs. of beef per hour; and with a  $\frac{3}{4}$  h.p. motor, 375 lbs. per hour. The chopper can be removed and placed in the cooler so that cleaning after every run is unnecessary. It is made by the Cleveland Electric & Manufacturing Company, Cleveland, Ohio, and is driven by a Westinghouse Electric enclosed motor.

### Trade Publications

**How the Chief Engineer was Convinced**—Booklet just published by the B. F. Sturtevant Company of Canada which describes the supposed visit of a chief engineer to their works and deals particularly with the manufacture of their turbines.

**Air brake equipment**—Bulletins No. 54562 and 54563, dealing with parts of air-brake equipment, are being distributed by the Canadian General Electric Company. The former deals with type S motorman's valves, the latter with triple valves and brackets. Both are illustrated.

**OB Equipment**—The Ohio Brass Company have issued their catalogue No. 14, covering a complete line of perfected appliances used in the construction, maintenance and operation of electric railways, mine haulage systems and transmission lines. The catalogue consists of 600 pages of splendidly illustrated information. Both in appearance and content this publication is more like a text than a catalogue.

**Mr. W. P. Dobson** has been appointed Director of the Experimental Laboratories of the Hydro-electric Power Commission of Ontario. The laboratories are situated in Toronto. Following his graduation from the Faculty of Applied Science & Engineering of the University of Toronto, two years ago, Mr. Dobson was awarded one of the scholarships given by the University of Toronto Engineering & Alumni Association and in the interval has been doing research work on the electrical disturbances that affect high tension transmission systems.



# Current News and Notes

## Agincourt, Ont.

The first of a series of meetings to be held for the discussion of the hydro radial by-laws to be submitted on September 21st was held in Agincourt on the evening of August 5th. The chief speaker was Sir Adam Beck, chairman of the Hydro-electric Power Commission of Ontario, who explained in considerable detail the plan outlined by his Commission. It was calculated that the road will cost \$40,000 per mile; the length of line at present considered is 105 miles. The speaker stated that the Dominion Government had not yet decided to grant the subsidy asked for of some \$6,000 per mile and that, whatever the result of the by-law voting, construction would not be proceeded with without government aid unless it could be clearly demonstrated that the road would be a paying proposition. It was pointed out that only the highest class of roadbed, overhead construction and rolling stock would be used, so that the best of service could be maintained. Some 300 electors were present at this first gathering and were apparently unanimous in their desire for the commencement of the work at the earliest possible moment.

## Berlin, Ont.

The illumination of King Street from Union Street on the north to the city limits on the south is being considered by the city council.

## Bathurst, N.B.

The Bathurst Lumber Company, Bathurst, N. B., have just commenced the construction of a pulp mill which will be electrically driven. The power house equipment will consist of four 576 h.p. boilers designed for a working pressure of 175 pounds with 150 degrees superheat. Two of these will be equipped with ovens for burning sawmill refuse, the other two will be equipped with underfeed stokers. The turbine room will contain two 1875 kv.a., 60 cycle, 2400 volt bleeder type turbines (Canadian Westinghouse) together with jet condensers and necessary exciters. The current will be stepped down to 550 volts through a bank of single phase transformers, and the motors will be 550 volt machines. There will also be a small bank of lighting transformers to supply the requirements of all the buildings in connection with the mill. The switchboard equipment will consist of all necessary generator panels, transformer panels and about nine or ten feeder panels. Mr. A. A. MacDiarmid is the power engineer.

## Belleville, Ont.

By a majority of 665 to 22 the electors voted to grant a ten-year lighting franchise to the Trenton Electric & Water Company. Along the main streets nitrogen filled tungstens will be used with series mazdas in the residential districts.

## Bolton, Ont.

The recent by-law authorizing the council to take over the plant of the local company and to close a contract with the Hydro-electric Power Commission for a supply of power was carried by a large majority.

## Chilliwack, B.C.

The new street lighting system recently installed by the British Columbia Electric Railway Company in Chilliwack, the terminal of the company's Fraser Valley line, has received the unqualified endorsement of the citizens. The sys-

tem embraces 102 street lights of 100 watt capacity each, and covers the business and residential portions of the city. Formerly about eighty lamps of 32 candle power were in use, and the improvement is marked. Better still, the cost of the new service, covering treble the candle power per light, is the same as was paid under the old contract.

## Dresden, Ont.

A by-law was carried on July 21 by a large majority authorizing a contract with the Hydro-electric Power Commission of Ontario for a supply of electric energy.

## Edmonton, Alta.

Another power offer has recently been placed before the city council of Edmonton by Sir John Jackson, consulting engineer. The source of power would be the Rocky Rapids on the Saskatchewan River some 160 miles west of Edmonton. Three developments are proposed, which at the low water period will give, it is said, a minimum of 35,000 h.p. It is stated that the council is inclined to look on this proposition favorably, granting a franchise on a semi-profit-sharing basis.

Tramways, Limited, is a new company formed for the purpose of constructing a railway line from Edmonton to Fort Saskatchewan via Nanao, a distance of 18 miles. This company together with the Edmonton Inturban Railway Company is negotiating with the city with a view to securing running rights to some central point within the city limits. If a tentative agreement can be reached the rate-payers will probably be asked to vote on it.

## Hantsport, N.S.

The new plant has been installed and the street lighting system placed in operation. Forty watt tungsten lamps are placed on wooden poles every 200 feet.

## Hawkesbury, Ont.

A scheme is now being carried out for developing 10,000 horse-power at Bell's Falls, on the Rouge River, P.Q., for Thomas Ross and Son, merchants, of Hawkesbury. This is supplementary to a small power plant at present operated by the same firm. Owing to a horse-shoe formation of the river near the falls, the plan of development includes the construction of a tunnel from the dam, at one side of the bend, under a hill to the other side of the bend, where the power house is situated. This tunnel is being cut out from solid rock. The Rouge River empties into the Ottawa River, and in order to supply power and lighting to Hawkesbury, Vankleek Hill, the Riordon Pulp & Paper Company and others on the south shore, a submarine cable, supplied by the Canadian British Insulated Company, will be laid across the Ottawa River. This cable will be 4,200 feet, and of 22,000 volt working pressure. The plant will distribute power over a distance of about 27 miles, part of the present distribution system being utilized. Turbines will operate under 50 feet head.

Contracts have been let for the electrical equipment. The order for three 2,000 kw. generators, 2,300 volt stepping up to 17,500 volts; three 3-phase, 2,000 kv.a. transformers; a 75 kw. water-wheel driven exciter, and a 75 kw. motor-generator set has been secured by the Canadian General Electric Company, while the switchboard will be supplied by the Canadian Westinghouse Company. L. A. Herdt and W. Kennedy, Jr., Montreal, are consulting engineers on the electrical and civil sections respectively.



**New Denver, B.C.**

The power plant of the New Denver Light & Power Company was recently destroyed by fire. It is said the plant will be rebuilt at once.

**Halifax, N.S.**

The Nova Scotia Telephone Company cut in a new exchange on July 25th known as the "Lorne."

**Indian Head, Sask.**

Tenders are called by the Deep Lake Rural Telephone Company for the supply and construction of a complete telephone system.

**Lethbridge, Alta.**

For the first six months of the present year the municipal street railway system has a deficit of over \$19,000.

**Lachine, P.Q.**

With a view to provide an additional unit for use in case of emergency, the city of Lachine have obtained tenders for a horizontal turbine pump direct-connected to electric motor, which will be installed at the water works power house. The pump will have a capacity of five million U. S. gallons, per 24 hours, against a total head of 80 pounds (exclusive of suction lift which will be 12 feet) when operating at its proper speed. The pump will be direct-connected to a 3-phase, 60-cycle, 2,200 volt squirrel cage induction motor. The wiring between the motor and starting equipment and control panel and between panel and the bus bar will be in conduit. The control panel is to be equipped with a 5 amp. a.c. ammeter, with 400 amp. scale; a t.p., d.t., 2,500 volt, 500 amp., automatic oil switch; a t.p., s.t., 2,500 volt, 200 amp., non-automatic oil switch; two 400—5 amp. current transformers; a 2,200/110 volt potential transformer with fuses, and a volt meter with 175 volt scale.

The city of Lachine, P.Q., is about to install a conduit and house and street lighting system, from First Avenue to Broadway Street, a distance of 12,000 feet, practically the whole of which runs parallel with the canal. The conduits will contain seven ducts, of tile and fibre, which will provide for 2,200 volt wires for house lighting, 6,000 volt wires for street lighting, and wires for the fire alarm system, leaving three spare ducts. There will be 44 manholes. The power for the street lighting will be supplied by the Montreal Light, Heat and Power Company. The system will be series lighting by means of nitrogen filled lamps supported on 103 iron standards. The lamps will be placed 14 feet from ground to globe. The standards will be 100 feet apart, one being placed at the corner of each street. This system will replace one of arc lights placed 600 feet apart.

For lighting the houses on the main street branch conduits will be constructed 75 feet down each side avenue; the current will be carried up a pole and transformed from 2,200 to 110 volts and then distributed by service wires running at the back of the residences. Thirty transformers are to be provided. The other houses on the side streets will be lighted as at present from the existing poles. Mr. V. H. Dupont, of the firm of Dupont, Roy & Baudouin, Montreal, is the city engineer, and the contract for the work has been let to Dietrich, Limited, Montreal.

**Moosimin, Sask.**

The Ivanhoe Rural Telephone Company have awarded a contract for the construction of their telephone system to the Canada West Electric Company, of Regina.

**Montreal, Que.**

Mr. W. H. Rosevear has been appointed Canadian manager of the Independent Pneumatic Tool Company, Aurora, Ill., who have opened a branch at 334 St. James street, Montreal. The company are makers of "Thor" electric drills with universal motors for operating on d.c. or a.c. for 110 or 220 volts.

The Montreal Electric Service Commission have invited

tenders for an additional conduit, about 600 feet, from the end of St. Lawrence Boulevard to the harbor front.

The Montreal branch of the International Brotherhood of Electrical Workers have asked for a change in the conditions of labour. The most important clause of the agreement which they desire asks for the employment by contractors of union men only, or those holding a permit from the secretary of the union. It is also sought to obtain the appointment of a board of arbitration in case of dispute. The hours of work are to be nine per day, with time and a half for all overtime up to 10 p.m., and after that double pay, provided the men work continuously. Forty cents an hour is the minimum wage, foremen having three or more helpers receiving 45c an hour. All board and expenses of men on out-of-town work must be paid by the contractors. Under a penalty of a fine, men are to be prohibited from doing private work of any kind while employed under terms of the agreement.

During the year ended June 30 last the earnings of the Montreal Tramways Company totalled \$7,142,804, an increase of \$388,576, or 5.75 per cent.; while the expenses were \$4,206,114, a gain of \$173,450, or 4.30 per cent.; and the net earnings \$2,936,689, an addition of \$215,126, or 7.90 per cent. The ratio of operating expenses to earnings was 58.89 per cent., compared with 59.71 last year, which is considered satisfactory. After deducting the city's share, bond and debenture interest, and taxes, the net is \$736,836, an increase of \$98,505. The dividend absorbs \$242,056, leaving a surplus of \$494,780, of which \$82,236 is appropriated to discount on bonds sold, and \$275,000 to contingent renewal account, the balance of \$137,543 being transferred to general surplus. The number of passengers carried was 168,472,952, car earnings per passenger 4.11, transfers 58,120,066; total passengers carried 226,593,018, and car earnings per passenger total carried 3.05. The sum of \$829,706.18 was expended on the maintenance of the company's properties, plant and equipment, and charged to operating expenses. This amount, together with the amount of \$417,124.99 charged to renewal account makes a total expenditure of \$1,246,831.17 during the year on the upkeep of the company's properties. This amount is equal to 17.46 per cent. of the gross earnings.

Large additions were made to the rolling stock of the company during the past year. A new type of motor car and trailer very materially helped the service on St. Catherine street, its main line, and the company is now considering the advisability of building more cars of this type as requirements may warrant. The increased rolling stock and extensions made necessitated further extensions of the power requirements, which has also been materially increased during the past year. The company has also completed a large portion of the rebuilding of its track, which it is proposed to continue as fast as possible.

The Northern Electric Company has recently received a large contract for the Montreal Light, Heat & Power Company which covers approximately 80,000 feet of 300,000 c.m. 3-core, 13,200 volt paper-insulated, lead-covered power cable. Two stretches of this cable run from the M. L. H. & P central station on Ottawa street to their Cote St. Paul station, while five lengths are to be laid tying in their Cote St. Paul station with their new LaSalle steam plant.

At the annual meeting of the Canadian Light & Power Company the old board of directors and executive were elected as follows: F. Howard Wilson, president; E. A. Robert, vice-president; George G. Foster, K.C.; J. M. McIntyre, N. Curry, R. N. Smyth, Wm. C. Finley, H. J. M. Wilson, F. J. Shaw and J. W. McConnell.

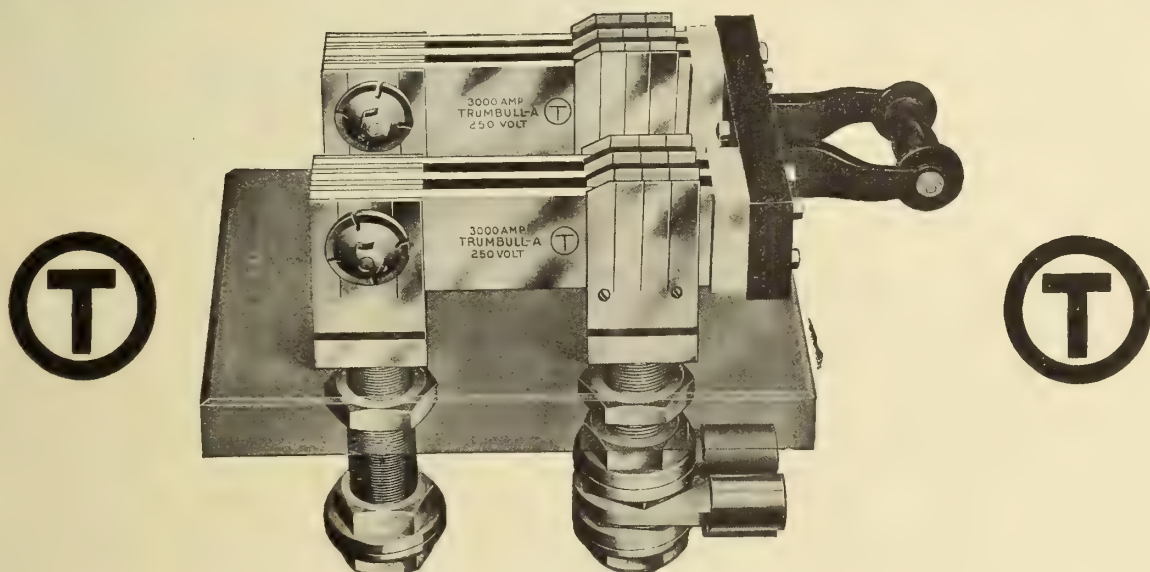
At the meeting of the Montreal Public Service Corporation two additions were made to the board, P. J. McIntosh, of New York, and Hon. N. Curry being the two new members.



# TRUMBULL

"Circle T"

# Knife Switches



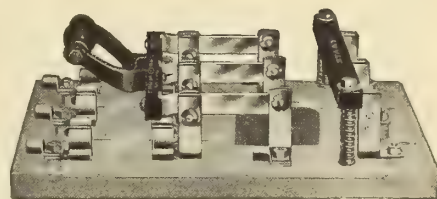
3000 Amp., 250 Volts. Type "A"

## 30 to 5000 Amperes (all styles)

All current carrying parts of Trumbull Type "A" Switches are of pure drawn copper designed to carry easily 100 per cent. overload. The blades have strong reinforcing blocks at the ends, fastened by screws into the fibre cross-bar. The fibre is pre-shrunk by baking for several weeks. The patented handles cannot work loose.

Only the finest workmanship and material are employed in Trumbull manufacture and the most careful attention is given to the minutest details in assembling and adjustment. We carry a stock of our standard material, packed and ready for immediate shipment upon receipt of order.

We manufacture a full line of Knife Switches, Snap Switches, Panel Boards, Cabinets, Switch Boards, Cut-Outs, Rosettes, Receptacles, Service Boxes, Insulating Joints and other Electrical Supplies. If you haven't a catalog, you should have one. Write for it today.



Motor Starting Switches showing straps on back

## The Trumbull Electric Mfg. Co.

PLAINVILLE, CONN.

NEW YORK  
114-118 Liberty St.

CHICAGO  
15 S. Desplaines St.

BOSTON  
76-78 Pearl St.

PHILADELPHIA  
138 N. 10th St.

SAN FRANCISCO  
84-88 Second St.



**Nelson, B.C.**

R. A. Brown, city electrician, Calgary, visited Vancouver and other Coast points recently. On his way west Mr. Brown took in the Chaka Mika carnival at Nelson and inspected the city power plant, of which he had charge prior to his removal to Calgary.

**North Vancouver, B.C.**

By a vote of 325 for to 130 against, the ratepayers of the city of North Vancouver declared in favor of purchasing the franchise and holdings of the Vancouver Power Company on the north shore of Burrard Inlet. The question will be decided by the council of 1915. Had the by-law been defeated no action could have been taken again until 1924.

**Outremont, Que.**

A contract for 1,500 nitrogen-filled lamps for the street lighting system of Outremont, Que., has been awarded to the Northern Electric Company, Limited. The same company have been given an order for 23,000 feet of lead-covered cable and 3,000 feet of armoured cable. The illumination standards will be supplied by the William Hamilton Company, of Peterborough.

**Port Arthur, Ont.**

A by-law was submitted on August 6th authorizing the expenditure of some \$33,500 for street railway extensions.

**Prince Rupert, B.C.**

The city of Prince Rupert at present is developing electricity by means of a steam plant, but has money in hand for the installation of its own hydro-electric plant to be constructed at Lake Woodworth. Several years ago the Prince Rupert Hydro-Electric Company acquired the charter of a pioneer concern which proposed to develop electric energy from Falls River and Khtada River, about thirty-five miles up the Skeena River, and the right to do business in the city has been sought for some time without success. The request is being vigorously opposed by many of the citizens, who see in it the destruction of their plans for the financial success of the city-owned plant. William Manson, M.P.P. for Skeena district, Mayor Newton, of Prince Rupert, and city engineer Mason, passed through Vancouver on July 16th en route to Victoria to oppose before the executive council of the provincial government the entrance into Prince Rupert of the Prince Rupert Hydro-Electric Company until the consent of the people has been obtained in the passage of a by-law.

**Penticton, B.C.**

In connection with plans for the operation of an electric railway line between Oroville and Penticton, the Okanagan Valley Electric and Power Company recently acquired the Oroville electric light plant from the Similkameen Power Company, and will develop the power at Similkameen Falls to the fullest extent.

**Regina, Sask.**

The operation returns of the municipal street railway system, Regina, for the week ending August 1st are as follows: revenue, \$6,994.40; passengers carried, 159,610.

**Saskatoon, Sask.**

Contracts have been awarded to the Escher Wyss Company for equipment in connection with the water works system.

**Shoal Lake, Man.**

Contracts have been awarded for equipment in connection with the Shoal Lake, Man., electric light plant as follows: Campbell oil engine to the Refrigeration Engineering Company, Winnipeg; generator and switchboard, pole line materials and construction to the Canadian General Electric Company; power house building, E. R. Snider, Shoal Lake.

The John Galt Engineering Company are consulting engineers.

**Stratford, Ont.**

On August 1 the new street lighting system was turned on in Stratford, Ont. The lights used are nitrogen-filled tungstens.

**Shawinigan Falls, Que.**

The Belgo Canadian Pulp & Paper Company, Limited, will in the near future install a 500 h.p. steam turbine, the slow speed shaft to run 250 r.p.m. The steam pressure on the turbine inlet will be about 110 lbs. with a maximum of 20 lbs. pressure on the exhaust; the steam to be used for heating purposes.

**St. John, N.B.**

The New Brunswick Hydro-electric Company are attempting to arrange a schedule of rates with the city council of St. John. Following this it is stated to be the intention of the company to proceed with their hydro-electric developments.

**St. Thomas, Ont.**

Negotiations are proceeding between the representatives of the interested municipalities and representatives of the London & Lake Erie Railway & Transportation Company looking to the extension of the latter's line from St. Thomas to Aylmer.

**Victoria, B.C.**

The sum of \$75,000 voted at the last session of the federal parliament, will be expended in the extension and improvement of the Dominion telegraph service on Vancouver Island. The construction of a line almost to the northern end of the Island will alone cost about \$50,000. From the station at Campbell River the line will be run to Hardy Bay, thence across the Island to Quatsino Sound, and from there to Halberg and San Josef Bay, thereby giving a number of outlying settlements a long desired connection with the outside world. The line up the northern portion of the Island will also be of great service to the Fisheries Department and the Forestry Board. The minor extensions decided upon, include a wire from Clayoquot to Pharmigan, a settlement located on the Bear River. This will serve the mines at Pharmigan and Kalappa as well as the Mosquito Harbor Lumber Company. Another extension will run from Ganges, Salt Spring Island, by way of Fulford Harbor, Isabella Point and Pier Island to Sidney, thus furnishing an additional outlet to the Gulf Island system. The telephone service between Victoria and William Head quarantine station is also to be made thoroughly modern.

**Wapella, Sask.**

Tenders are called by the Great West Rural Telephone Company for the supply of material and the construction of ten miles of telephone system.

**Watrous, Sask.**

The Little Manitou Rural Telephone Company has awarded a contract to the Prince Albert Electric Company for the supply of material and the construction of a telephone system.

**Walkerville, Ont.**

The Walkerville Light & Power Company have been negotiating with the local hydro-electric commission looking to the purchase by the latter of the company's generating and distributing plant. It is understood that the negotiations have temporarily fallen through.

**Winnipeg, Man.**

The British-Canadian Engineering & Supply Company, of Winnipeg, have just secured the contract for the installation of a suction gas engine and producer plant for the town of Oxbow, Sask.



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Constitutes a very simple and absolute *perfect solution* of problems involved in coupling alternating-current machines in parallel without danger or sensible disturbance of circuit conditions.

*The indications are infallible.*

*There is only one object to observe.*

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Send for catalog giving full *description of this unique instrument* and also our full line of A. C. and D. C. instruments for Switchboard, Portable and Laboratory Work.

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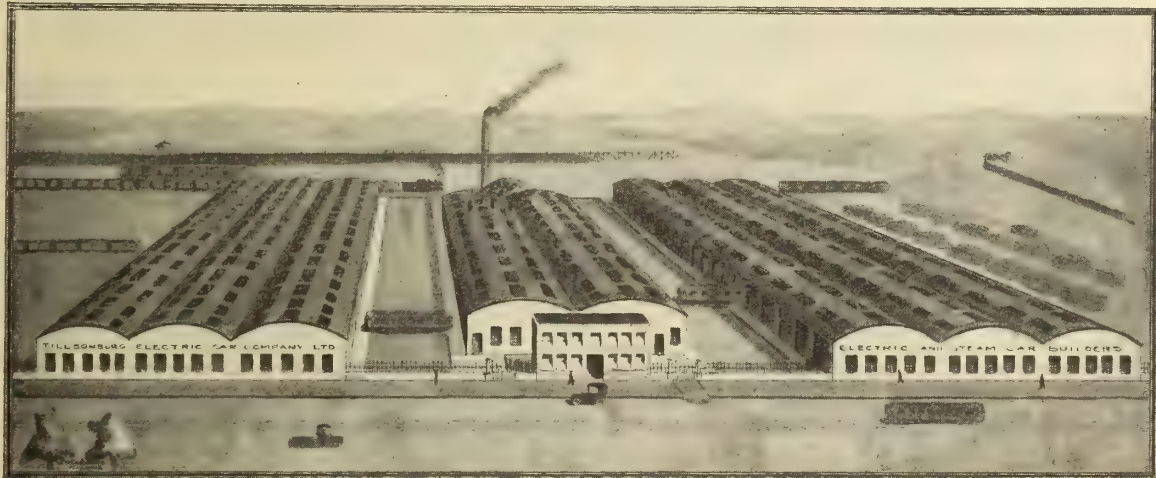
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Mr. Geo. H. Moseman, 176 Federal St., Boston, Mass.

Mr. Milton Mill, 915 Olive St., St. Louis, Mo.  
B. K. Sweeney Electrical Co., 2910 Huron St., Denver, Colo.  
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Walter P. Ambos Company, 1729

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### ELECTRIC CARS, SWEEPERS AND SPRINKLERS

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# Condensed Department

## Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

## CITY OF MOOSE JAW

### Tenders for Steam Pipe

Sealed tenders marked "Tenders for Steam Pipe," and addressed to the City Commissioners, Moose Jaw, Sask., will be received up till 12 o'clock (noon) on Wednesday, August 26th, 1914, for High Pressure Steam Pipe and Appliances for a 3500 horse power plant.

Plans and specifications may be obtained upon application to J. D. Peters, Electrical Superintendent, Moose Jaw.

The lowest or any tender not necessarily accepted.

JAS. PASCOE,  
GEO. D. MACKIE, } City Commissioners.  
W. F. HEAL,

Moose Jaw, July 28th, 1914.

16

## EMPLOYMENT WANTED

Electrical Switchboard Operator, married, desires change. Experienced in A.C. and D.C. work. Present position hydro plant, two years. References. Box 67, Electrical News, Toronto.

16-17

## SITUATIONS VACANT

Salesman and Designer for large Electric Fixture Manufacturer, competent to sell special work. Must be able to estimate costs and have knowledge of illumination. Excellent opportunity. Applications confidential. Apply Box 58, Electrical News, Toronto.

15-18

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LUMSDEN BLDG. (COR. ADELAIDE & YONGE) TORONTO.  
WRITE FOR TERMS. M. 3713.

## Lighting Schedule for September, 1914

Courtesy of the National Carbon Company, Cleveland

Date.	Light.	Date.	Extinguish.	No. of Hours
Sep. 1	0 40	Sep. 1	4 40	4 00
2	1 40	2	4 50	3 00
3	2 50	3	4 50	2 00
4	No Light	4	No Light	
5	No Light	5	No Light	
6	No Light	6	No Light	
7	6 50	7	9 00	2 10
8	6 50	8	9 20	2 30
9	6 50	9	9 50	3 00
10	6 50	10	10 20	3 30
11	6 40	11	11 00	4 20
12	6 40	12	11 50	5 10
13	6 40	13	0 50	6 10
14	6 40	14	1 50	7 10
15	6 40	15	3 00	8 20
16	6 40	16	4 20	9 40
17	6 40	17	5 00	10 20
18	6 30	18	5 00	10 30
19	6 30	19	5 00	10 30
20	6 30	20	5 00	10 30
21	6 30	21	5 00	10 30
22	6 30	22	5 00	10 30
23	6 30	23	5 00	10 30
24	6 20	24	5 00	10 30
25	6 20	25	5 00	10 40
26	6 20	26	5 10	10 50
27	10 30	27	5 10	10 50
28	11 40	28	5 10	6 40
29	0 40	29	5 10	5 30
30		30	5 10	4 30

Total Hours.....183.30

## MICA

Canadian Amber

Indian Ruby

### For Every Purpose

Cut or uncut, stamped to pattern. Selected to cut any size or in regular grades. Splittings, Washers, Gramophone Discs. I also carry the largest stock of Stove Mica in Canada.

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BRANCHES—34 West 33rd St., New York Kodarma, Bengal, India

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### Special Advantages:

NO LEAD. NO ACID. NO CELLULOID CASE

#### Strength:

Cannot be hurt with overcharging or running down to Zero.

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Smaller than any other Accumulator.

#### Life:

Ten times the life of Lead Accumulators.

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The Voltage keeps practically the same all the time used.

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The Lightest in the World.

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Far in advance of any other Accumulator for Hand-lamps, because it can be left for any length of time without deteriorating. Absolutely the Best for Miners' Lamps, because it gives off the same amount of current the whole of the time it is in use, maintaining the light evenly throughout the day. Most satisfactory for Electric Self-starters. A great advantage over any other Accumulator for lighting cars.

Fully Descriptive Catalogue sent on application to the Makers

## WORSNOP AND CO., LTD.

LAMP WORKS, HALIFAX, ENGLAND.

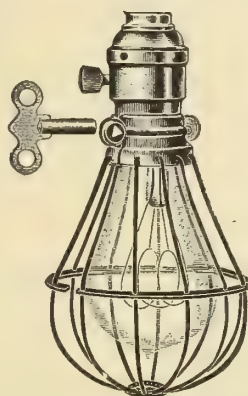
Who are also the largest makers of Electric Motor Lamps in the World.

### GUARANTEED TO BE SUPERIOR TO ANY OTHER ACCUMULATOR IN THE WORLD.

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THE KEY TO SAFETY

## The Logical Guard To Use and Sell



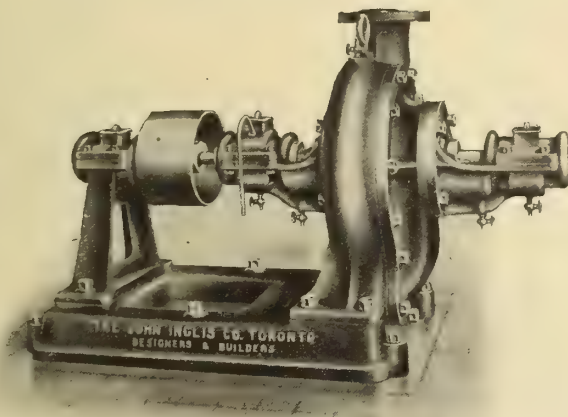
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It's double protective feature Absolute Safety against both Breakage and Theft; give it a selling value you can't get away from. Its reasonable cost to users, a good profit for dealers—make it the right guard to push. Fall and Winter is the time when Loxons save big money. Make no mistake—

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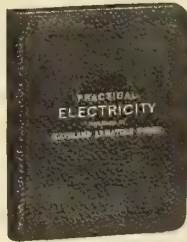
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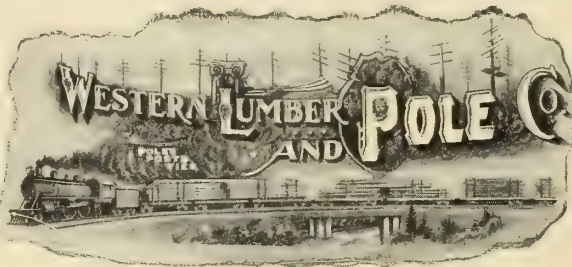
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In Single Cylinder, Twin, and Two or Three Cylinder Compound Designs,  
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### Open Tank Process

with the genuine

**Avenarius Carbolineum**

Doubles the life of your poles

Completely fills the pores and cracks

Compared to our method, the brush treatment is a makeshift

The cost is reasonable

Three years additional life pays back first cost and thereby

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What will poles cost in ten years?

Then add the cost of replacing poles and arms

Our new plant at

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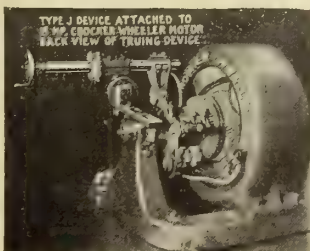
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Operates without removing armature. No shut down of motor or generator.

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No portable slide-rest with the danger of the tool digging into the commutator and numerous other chances of damage to the commutator or armature which are all overcome with this machine.



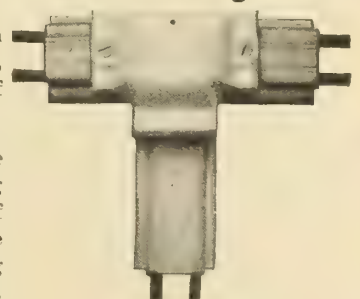
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A real time saver which means a Money Saver, making the best class of work.

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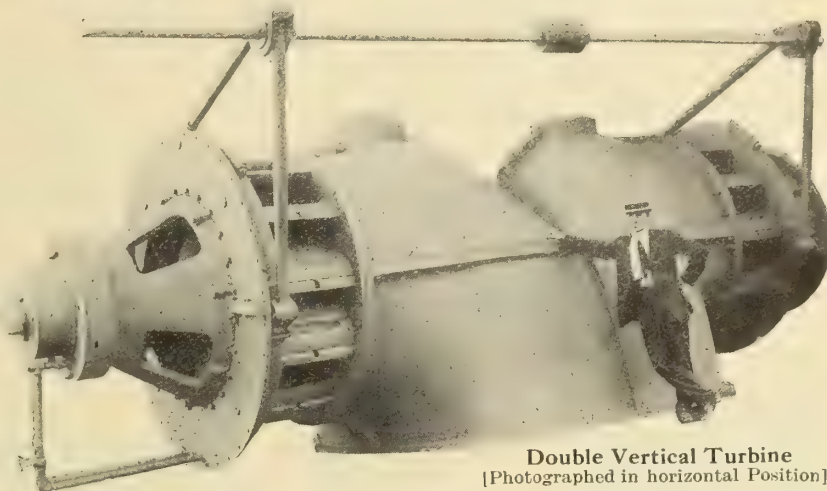
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Hand and power driven  
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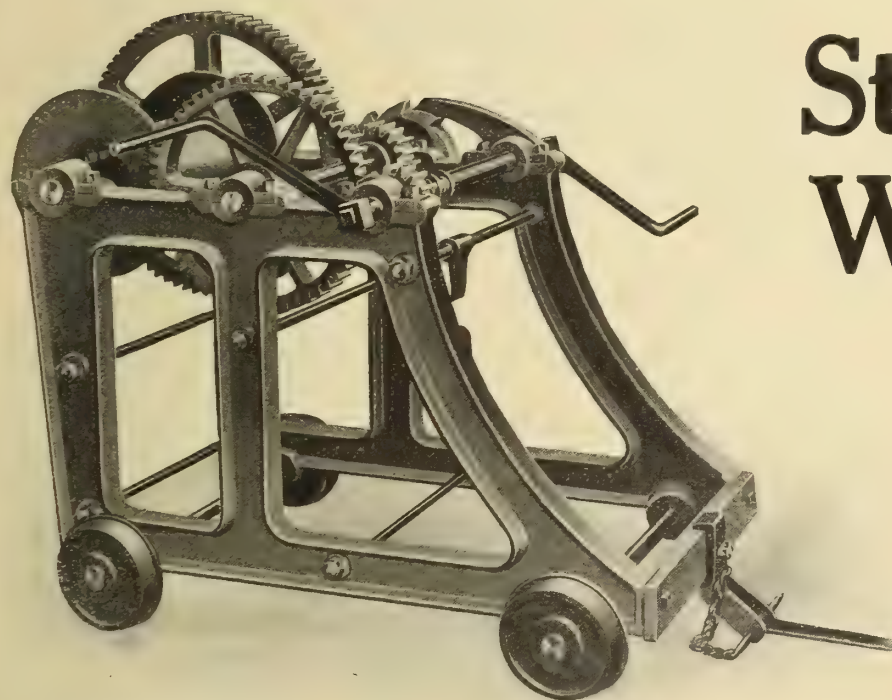
Machine Cut Gears  
Extra large stock patterns for  
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having wood and iron teeth.  
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Double Vertical Turbine  
[Photographed in horizontal Position]

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## Stop Log Winches



These stop log winches are double geared, have an all iron frame and are strongly built and powerful in operation.

We build a complete line of winches, head gate hoists, sluice gates, etc., suitable for all conditions.

*Catalogues and drawings on request.*

**William Hamilton Company, Limited**  
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# - M I C A -

We can supply your requirements in

## Canadian Amber Mica

Thumb Trimmed

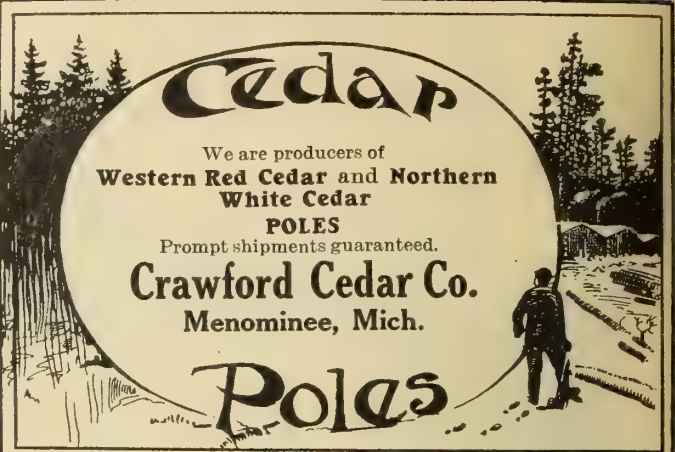
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With our mines at Rideau Lakes and unexcelled shipping facilities by rail and water, we are in a position to supply your requirements on shortest notice.

The Stoness-Anglin-Gilbert Mica Mining Co., Ltd.

Head Office and Factory

Kingston Ontario Canada



**Cedar**

We are producers of  
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**POLES**  
Prompt shipments guaranteed.

**Crawford Cedar Co.**  
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**Poles**

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# 1914 Standard Wiring

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"It settles disputes and, if referred to before wiring, prevents disputes."

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Washington.

Wire or write us for  
delivered prices.

# Cedar Poles

National Pole Co.  
Escanaba, Mich.

**NAUGLE**

**Pole & Tie Co.**

Main Office  
5 South Wabash Ave  
Chicago, Illinois

We have yards in  
Canada guaranteeing  
our motto:  
"SERVICE"  
"PRICE" "QUALITY"  
ONE QUALITY  
ANY QUANTITY

**POLES**



# YOU CAN'T BEAT OUR SERVICE

**ANY WAY  
YOU  
ARGUE**



## **You Cannot Delay When Repairs Are Needed**

As soon as anything goes wrong you want men on the job in a hurry, don't you? Yes, and you want to know that you are getting the work done right. Then remember, the next time you need repairs, that you will get guaranteed work and rush service by calling

**ADELAIDE 902 or 903 during the day.**

**BEACH 1723 or 1930, nights, Sundays or holidays.**

*What is it worth to YOU to know you can  
depend on our work.*

**The Electrical Maintenance & Repairs Co., Limited**

**Toronto**

**162 Adelaide St. West**

**Ontario**



## **Shipments on National Ranges can now be made**

If you haven't ordered a sample yet, get our interesting prices and order.

Let the merits of our new line present themselves.

Our New Line comprises

**Ranges (Two Models)**

**Portable Ovens**

**One and Two Disc Hot Plates**

**The National Electric Heating Co.**  
**TORONTO, CANADA**

**Limited**



# You Will Appreciate the "Arkless" Mechanical Indicator

After you have wasted time and lost money through delays caused by unlocated blown fuses, you will appreciate the accuracy of the "Arkless" Mechanical Indicator.

It is a private watchman for each fuse, whose sole work is to show instantly which fuse has blown. It is always on the job and all possibility of its not working has been removed.

Every "Arkless" Indicator is absolutely guaranteed to work perfectly. To save you money and reduce your fuse expense by saving time—by reducing delays caused by blown fuses.

When you buy an enclosed fuse you are paying for a reliable indicator—an "Arkless" Mechanical Indicator. Insist upon "Arkless" Fuses and get 100 cents worth of fuse value for each dollar invested.

Send today for catalog 22. It gives complete information and prices.

<b>Bentz-Richardson Co., Limited</b>	<b>McNaughton-McKay Electric Co., Limited</b>
Western Canadian Agents	Eastern Canadian Agents
114 Phoenix Block, Winnipeg, Man.	216 Wyandotte St. East, Windsor, Ont.

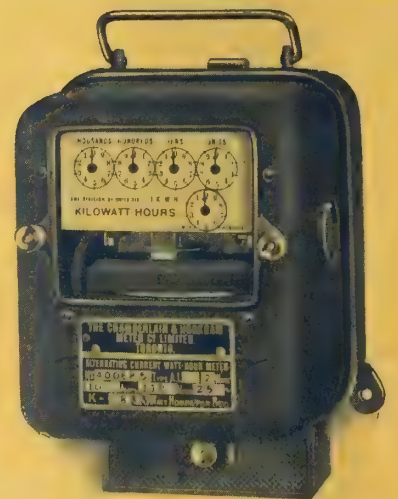
**Detroit Fuse & Manufacturing Company**  
1404 Rivard St., DETROIT, MICH.



The First Essential of a meter is unquestionably Accuracy Maintained for Long Periods.

C & H Meters are particularly well equipped for this important requirement, possessing the following features which are **not** found collectively in any other meter.

**High Torque**  
**Slow Speed Worm      Slow Speed Disc**  
**Jewelled stepbearings on both main and worm shafts**  
**Simple and high grade disc movement**

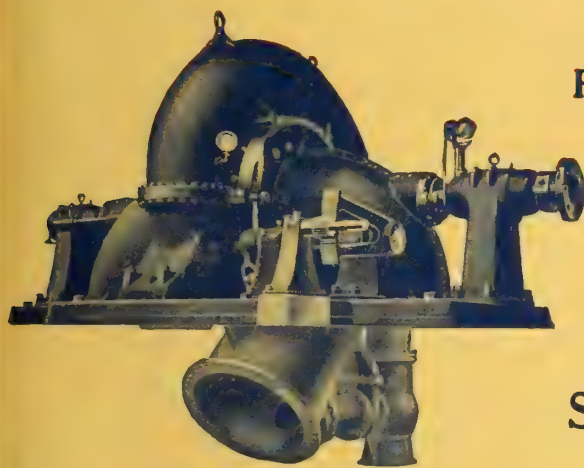


**Chamberlain & Hookham Meter Co., Limited**  
TORONTO, 120 Richmond St. W., ONTARIO      WINNIPEG, 61 Albert St., MANITOBA  
Spencer & Aspinall, 617 New Birks Bldg., Montreal, P.Q.



# Electrical News

Generation, Transmission and Application of Electricity



5250 Horse Power 275 Feet Head

## 90% EFFICIENCY From SMITH HYDRAULIC TURBINES

Recent tests at Holyoke, Mass. of Smith Turbines have again proven their superiority over any turbine now manufactured.

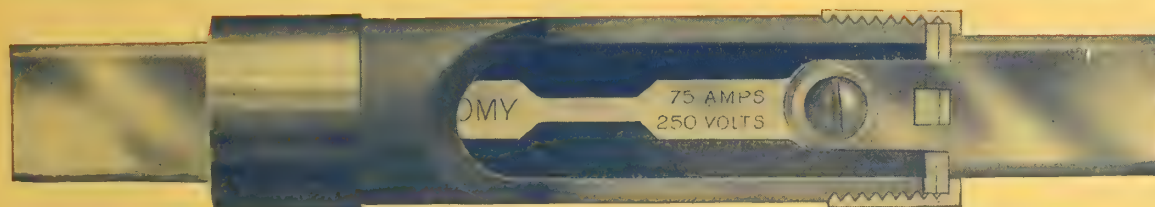
These tests showing efficiencies from 89% to over 90%.

We design and build turbines for heads from 5 feet to 650 feet.

*Send for Bulletin N*

**S. Morgan Smith Co., York, Pa.**

Branch Offices: 176 Federal St., BOSTON, MASS.  
614 American Trust Bldg., CHICAGO



**"Look for the Gray Shell"**

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are reducing fuse Maintenance expense over 80 per cent by using

## ECONOMY RENEWABLE FUSES

**They use Economy Renewable Fuses for these reasons:**

- First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
- Second, because it is the only renewable fuse that is uniformly rated.
- Third, because it is the only design so far produced that provides the desired electrical characteristics.
- Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
- Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
- Sixth, because they meet the performance specifications governing the use of such devices.

### **Special Announcement !**

Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

*Write for Bulletin, Prices and Discounts*

**Economy Fuse & Mfg. Co. of Canada, Limited**

Herald Building, Montreal

ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.



# UNDERGROUND CABLES

## LOW AND HIGH TENSION

FOR LIGHTING,  
POWER,  
STREET-  
RAILWAYS,  
TELEPHONE,  
TELEGRAPH.



ARMoured  
CABLES FOR  
STREET  
LIGHTING,  
PAPER  
INSULATED  
CABLES OF ALL  
DESCRIPTIONS,  
RUBBER INSULA-  
TED CABLES &c

Also Bare and Weatherproof Wires and Cables,  
Magnet Wire, Flexible Cords, &c.

### Galvanized Iron Wire and Strand

HEAD OFFICE:

## MONTREAL, CANADA

BRANCHES:

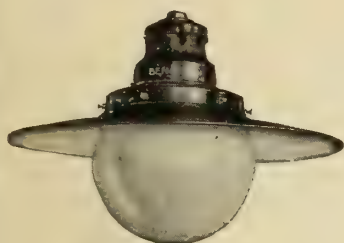
Toronto,

Winnipeg,

Halifax,

Vancouver.

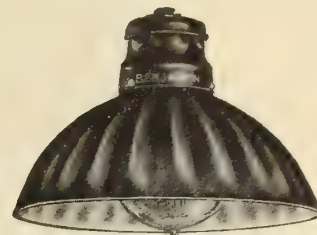




Cat. No. 6121



Cat. No. 698



Cat. No. 6179

## Benjamin Fixtures for Gas Filled Lamps

Newest Designs  
Properly Ventilated  
Substantially Built  
Best of Copper and  
Enamelled Steel  
Materials.

*Write for Revised  
Bulletin 222.*

**Benjamin Electric Mfg.  
Co. of Canada, Limited**  
TORONTO                      ONTARIO



Cat. No. 6103



Cat. No. 5557



Cat. No. 6116

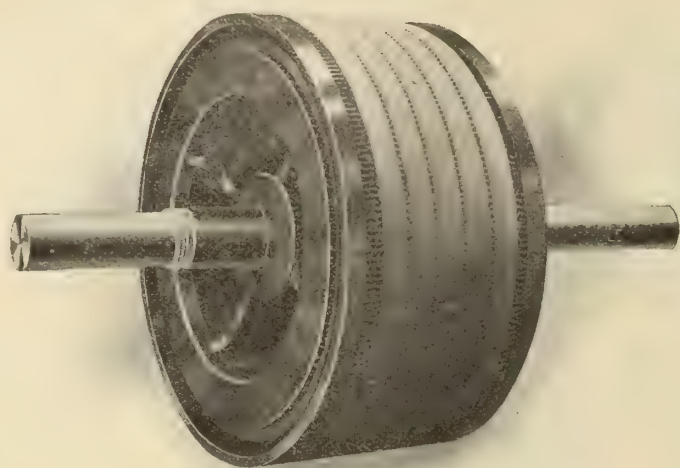


Cat. No. 695



Cat. No. 6271





# PEEBLES FIRST

demonstrated the superiority of the  
**Cast Rotor End-Ring**

*Have you noticed how the  
other fellows are copying it?*

**FERRANTI ELECTRICAL COMPANY OF CANADA  
LIMITED**

90 Sherbourne St.

**TORONTO**

Farmers Advocate Bldg.

**WINNIPEG**



## ANNOUNCEMENT

On account of the cessation of shipments of Ceylon Graphite, the Stackpole Carbon Co. of St. Marys, Pa., announce that they have sufficient stock for any emergency, and are prepared to give their Canadian customers perfect service without any advance in price. We manufacture 40 grades and will guarantee satisfaction.

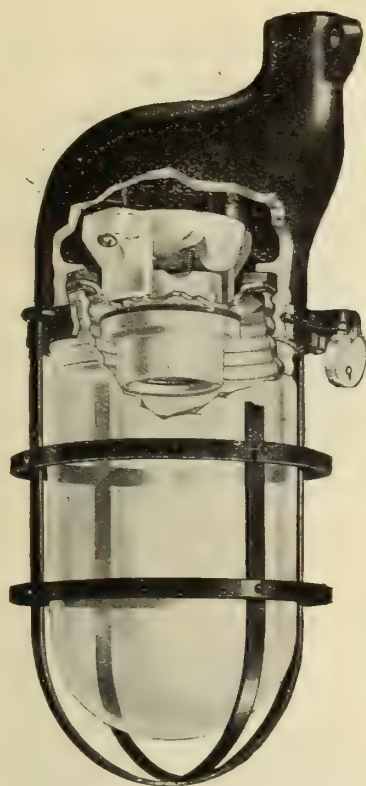
Send a sample worn brush, with details of your requirements, to our Canadian Agent—

**R. H. NICHOLS**

Dineen Building

**Toronto**





Broken-away View, showing  
interior.

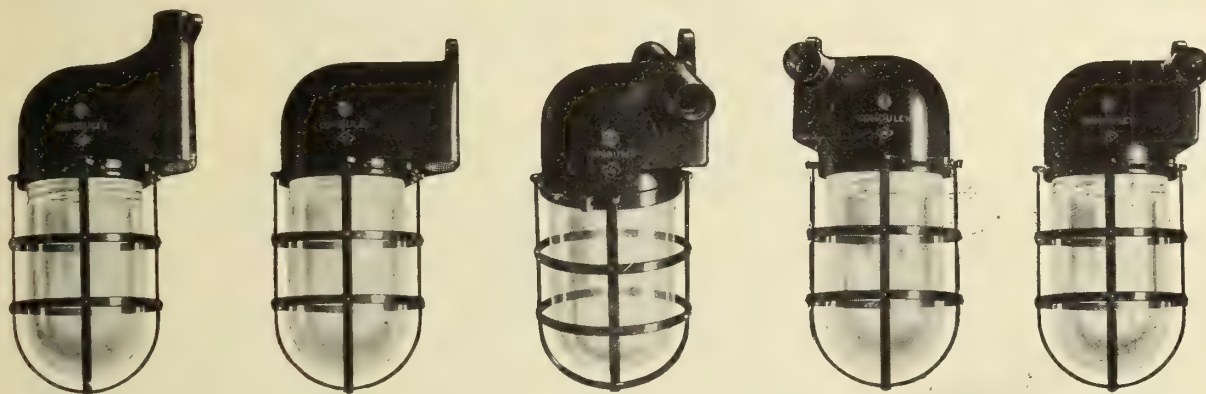
# Condulets of V and VH Series

## Vapor, Gas and Dust-Proof

For marine work, and in breweries, refineries, flower mills or wherever there is dampness, gas or fine dust.

These condulets remain vapor, gas and dust-proof even though globes be broken or removed for lamp renewals.

Illustrations below show a few of the many forms in which these series of condulets are made.



*Order from your jobber. If he does not stock them, write us*

## Crouse-Hinds Company of Canada

Limited

Main Office and Works:

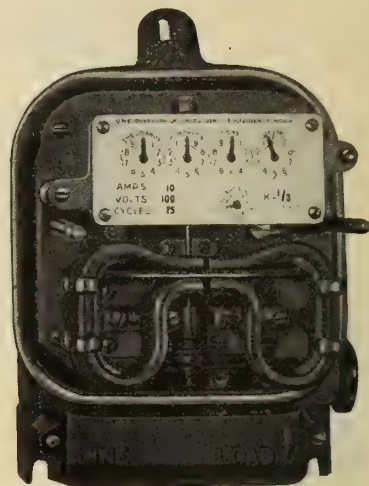
Toronto - Ontario - Canada





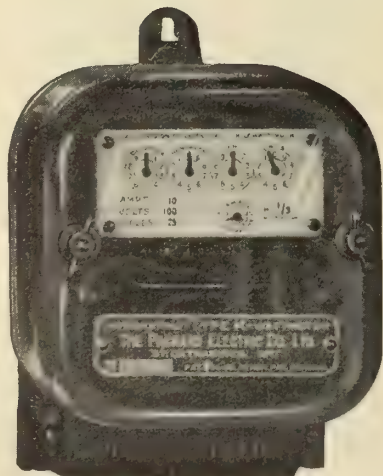
# Made in Canada

## *Packard*



Recent improvements have made the **Packard**, with no exception, the best meter anywhere. Re-inspections of the Government have thoroughly demonstrated that the "**Packard**" will retain its accuracy of calibration over years of service.

Install "**Packard**" and guarantee your meter service.



The **Packard Electric Co., Ltd.**  
Factory at St. Catharines, Ont.

General Sales Office, N. W. Office and Warerooms  
Traders Bank Bldg., TORONTO WINNIPEG

LARGE STOCKS CARRIED AT  
St. Catharines and Winnipeg; St. John Railway Co., St. John, N. B.;  
General Supplies, Limited, Calgary, Alta.;  
Rudel-Belnap Machinery Co., Canadian Express Building, Montreal, Que.



# SWEDISH GENERAL ELECTRIC, LIMITED

(Successors to Kilmer, Pullen & Burnham, Limited)

Trade

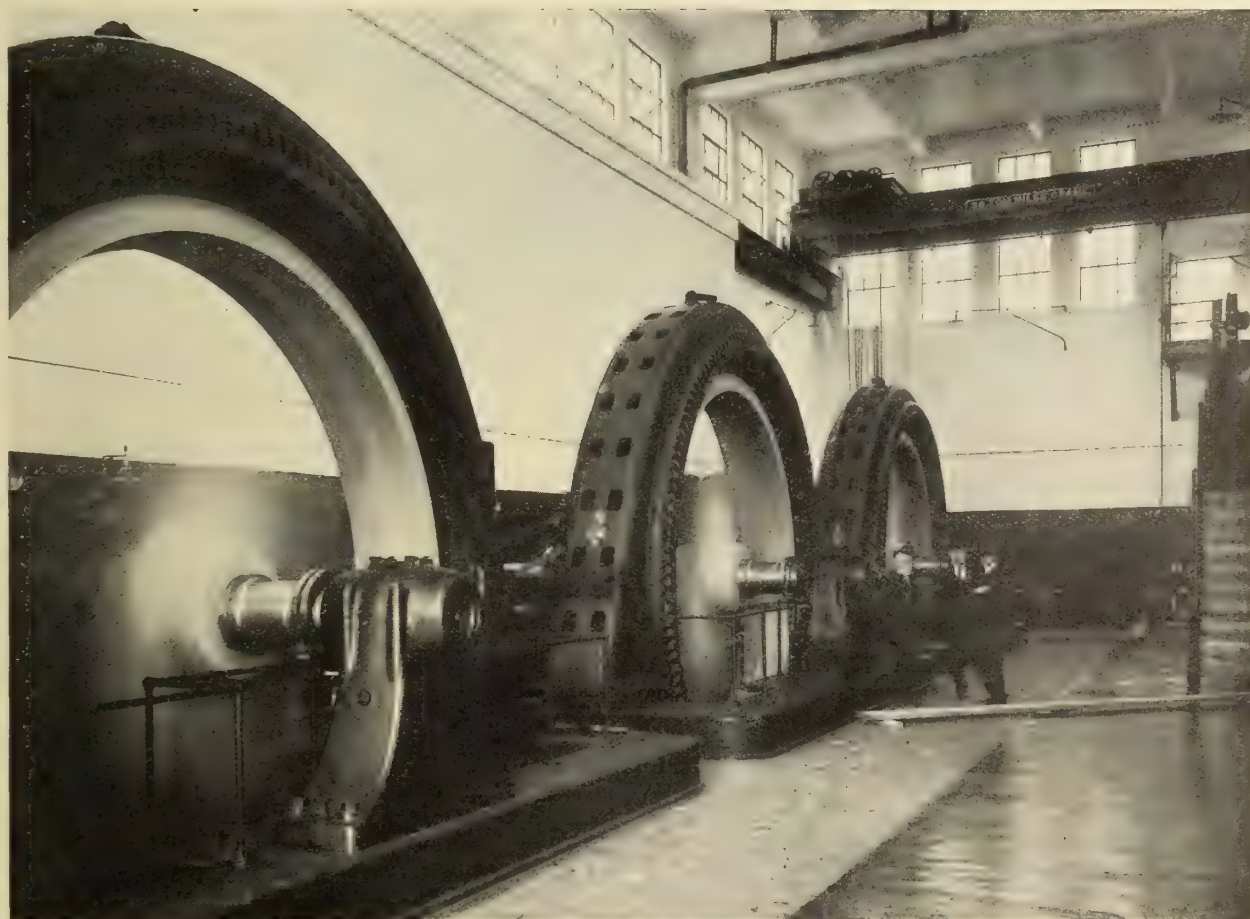


Mark

We Have Now Installed in Canada

## Over 150,000 H. P.

In Generators and Motors in Sizes from 1 to 6,000 H. P.



3—3750 KVA 2300 Volt, 3 Phase 60 Cycle, 164 RPM, Water Wheel Type, AC Generators installed in

**The E. B. Eddy Company's Plant, Hull, P. Q.**

*We solicit your enquiries.*

**Head Office—TORONTO**

1009-11 Kent Bldg.

**Branch Office—MONTREAL**

St. Nicholas Bldg.

**General Supplies—CALGARY**



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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers





Shea's Theatre, Toronto. A "GALVADUCT" Building.

G  
A  
L  
V  
A  
D  
U  
C  
T

## "Safety First"

In the most modern building the electric wiring is all carried in "channels of safety."

### "GALVADUCT"

The most perfect interior construction conduit on the market.  
Recognized as the standard of high quality.

Always specify "Galvaduct" or  
"Loricated" Conduits

### "LORICATED"

A high - class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply  
you—write us

## Conduits Company Limited

Toronto — Montreal

L  
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D





TRAIN SHED, C.P.R., WINDSOR ST. STATION, MONTREAL  
Contractor—L. H. Neilson Company, Pittsburg, Pa.

## Good Lighting Pays

It would be almost impossible to find a better example of scientific lighting than that recently made in the train sheds of the new Windsor Station, Montreal.

The above illustration of that installation testifies to what you may expect from a lighting system which combines "Northern Light" lamps in their proper reflectors, scientifically arranged to give perfect illumination.

Besides "Northern Lights" which are the most efficient and economical lamps made, we can also supply reflectors to be used with these lamps, which will exactly fulfil your individual requirements.

Much of the real effect is lost in the cut shown above, but we will be glad to send you a large print taken from the original negative. Suppose you write our nearest house for this today.

*Northern Electric Company*  
LIMITED

Montreal  
Regina

Halifax  
Calgary

Toronto  
Edmonton - Vancouver

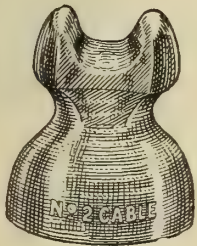
Winnipeg  
Victoria



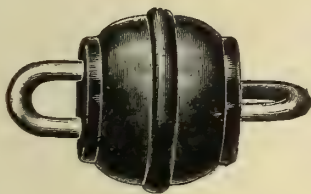


# *Northern Electric* Line Construction Material and Tools

Continuous service is the insurance that goes along with *Northern Electric* line material and tools.



The name *Northern Electric* is a full guarantee of the serviceability and durability of the material it covers.

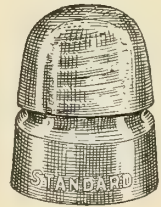


thorough investigation of its quality.

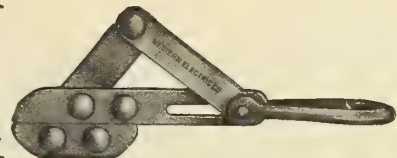
No material is sold under that name unless it has been subjected to



Every piece of line material is manufactured under the most rigid specifications and careful supervision.



All of which means that a line of



*Northern Electric* line material will stand the test of time and weather.

*We can sell you whatever you  
need for your lines*

*Northern Electric Company*  
LIMITED

MONTREAL  
HALIFAX  
TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA



## The Lock On Guard

Supersedes all other Guards  
and is

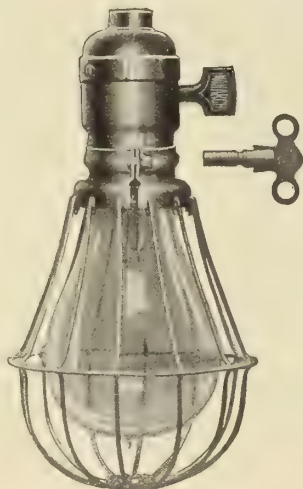
Made in Canada

By

**THE MONARCH ELECTRIC CO.**

LIMITED

ST. LAMBERT, P.Q.



No. 1—Lock On Guard

ORDER  
LOCK ON GUARD

No. 1—For 16 c.p.  
Lamps.

No. 2—For 16 c.p.  
Lamps.

No. 3—For 32 c.p. and  
60 Watt Lamps.

No. 4—For 32 c.p. and  
60 Watt Lamps.

Nos. 1 and 3 fit Standard  
Sockets.

Nos. 2 and 4 fit Porcelain  
Sockets also

Nos. 9366-43310 and  
60666 Sockets.

## Electrical Decorations For Rent

**W**E make a specialty of High-Class  
Decorations for Street Fairs, Carni-  
vals, Celebrations, Centennials, Old  
Home Weeks, Street Conventions, Conclaves,  
Parks, Buildings, Auto Shows, Balls, Fairs,  
Dances, Banquets, Industrial Expositions,  
Food Shows, Christmas and New Years, etc.

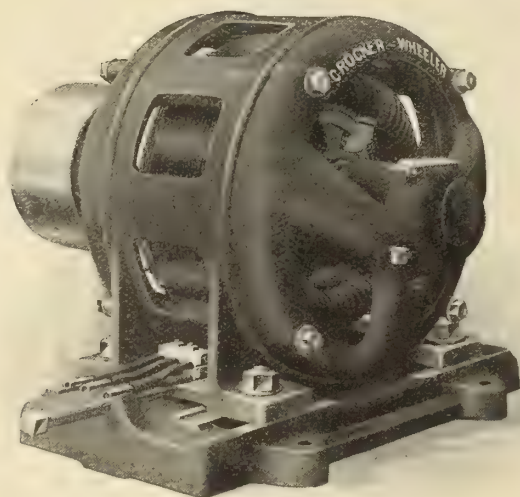
Our decorations are elaborate, appropri-  
ate and refined. We carry a complete line  
of Electrical Set Pieces, Signs, Streamers of  
Lights and Bunting for all Lodges, Orders  
and all occasions. Get our prices and designs.

Contractors and Dealers are re-  
quested to get in touch with us.

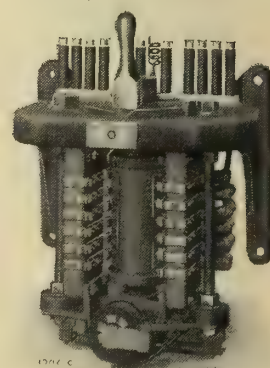
**Electrical Decorative and  
Equipment Company**

70 Lombard Street, Toronto, Ont.

Long distance phone Main 3634



## Transformers and Motors



NOTE:—  
Our oil immersed  
No-voltage release

**THE CANADIAN  
CROCKER-WHEELER CO.  
LIMITED**

MANUFACTURERS AND ELECTRICAL ENGINEERS

Head Office and Works  
ST. CATHARINES

District Offices  
MONTREAL, TORONTO, VANCOUVER



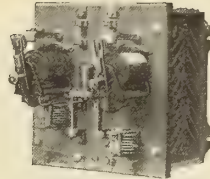
# CUTLER-HAMMER



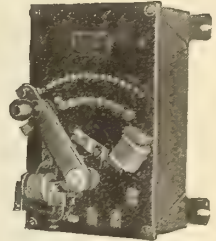
A. C. Slip Ring Motor Speed Regulator.



6-inch Speed Regulator for Small Motors.



Automatic Motor Starter.



Combination Motor Starter and Speed Regulator.

## Motor Controllers For Every Motor Application

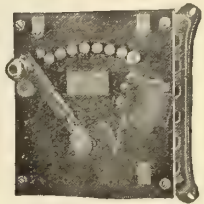
Cutler-Hammer motor controllers are made for every conceivable application of the electric motor. In fact, many applications have been made possible and many others made more satisfactory through the agency of Cutler-Hammer controllers.

If your work has to do with the installation, application or operation of electric motors, you might as well have the benefit of the 20 years' experience of our specialized engineering department.

Whether your control problem is somewhat out of the ordinary or not just put it up to the Cutler-Hammer engineers. Information and literature will be forwarded to you promptly.



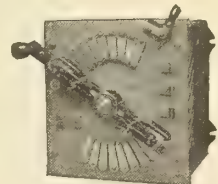
Motor Starter.



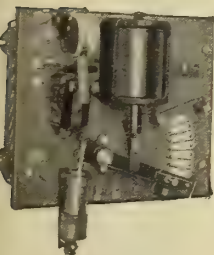
Motor Speed Regulator.



Enclosed Crane Controller.



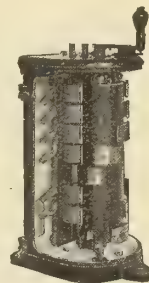
A. C. Motor Starter.



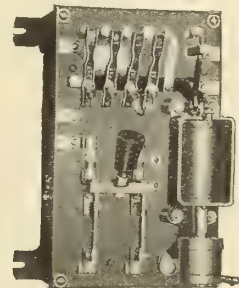
Automatic Motor Starter.



A. C. Self Starter for Single Phase and Spiral Cage Polyphase Motors.



A. C. Starter Drum Type.



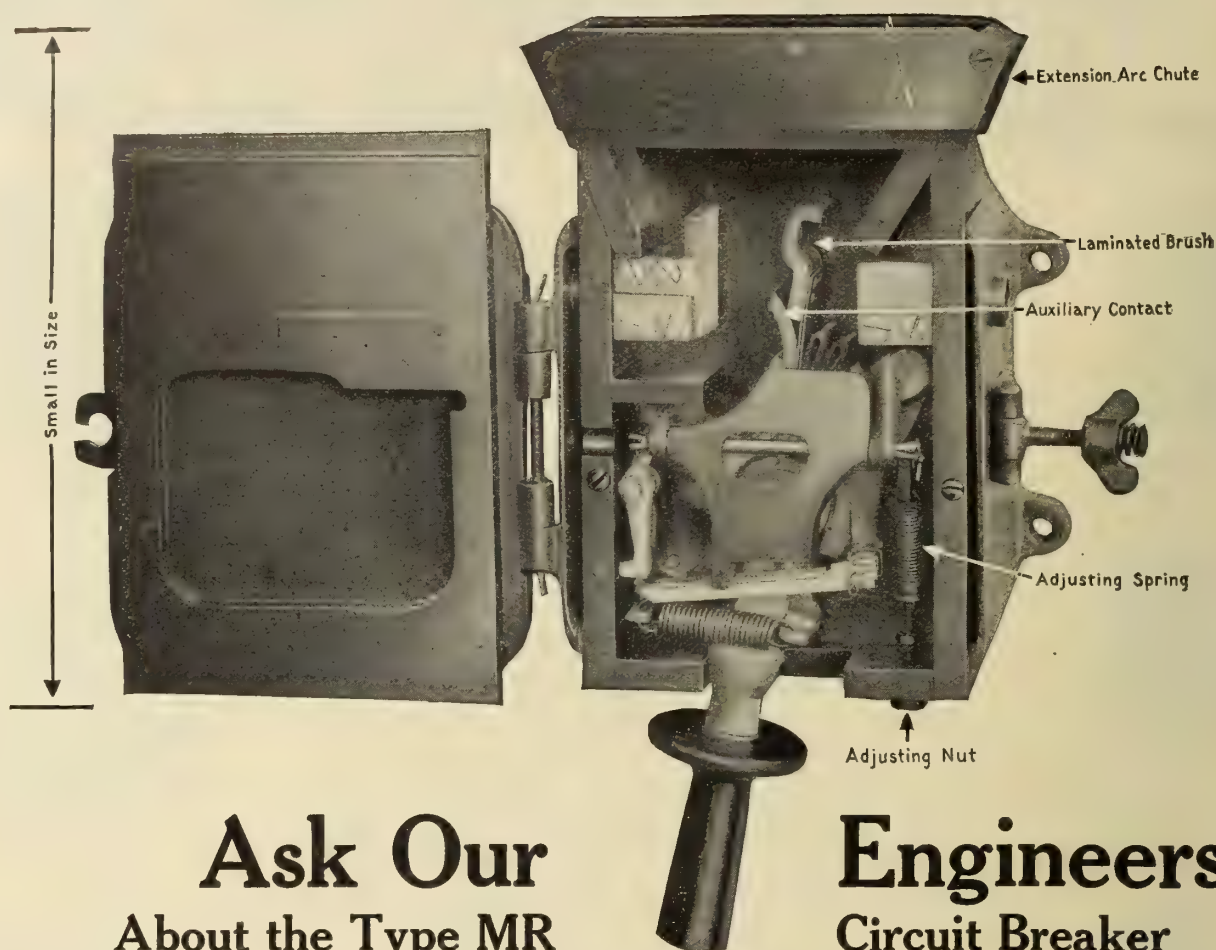
Automatic Motor Starter.

Bulletin 9600

**THE CUTLER-HAMMER MFG. CO. MILWAUKEE**

NEW YORK: 50 Church Street    CHICAGO: Peoples Gas Bldg.    PITTSBURG: Farmers' Bank Bldg.    BOSTON: Columbian Life Bldg.  
PHILADELPHIA: 1201 Chestnut Street    CLEVELAND: Schofield Building    CINCINNATI: Fourth Nat'l Bank Bldg.  
PACIFIC COAST AGENT: H. B. Squires Co., 579 Howard St., SAN FRANCISCO, San Fernando Bldg., LOS ANGELES  
and Morgan Building, PORTLAND, ORE.





**Ask Our  
About the Type MR**

**Engineers  
Circuit Breaker**

**FOR STREET RAILWAY SERVICE**

**Q—How large is the Type MR Form D breaker ?**

**A—**Approximately 8 x 12 x 6½ inches over all, handle excepted. The device is compact and inconspicuous.

**Q—What is the virtue of the extension arc chute ?**

**A—**It conceals the flash attendant upon breaking the circuit. Passengers are not startled.

**Q—Why is the main contact laminated ?**

**A—**To secure perfect contact with a wiping motion preventing dust or grit from binding the contact surfaces.

**Q—Why is there an auxiliary contact ?**

**A—**To hold the circuit until the main contact has moved away. This protects the main contact from burning or injury. The auxiliary contact is easily renewable.

**Q—What is the function of the adjusting nut and spring ?**

**A—**Turning the nut adjusts the spring to trip the breaker automatically at any point between the calibration limits plainly indicated on the device.

**CANADIAN GENERAL ELECTRIC CO.  
LIMITED**

*Manufacturers of Electrical Apparatus and Supplies  
for Railway, Light and Power Purposes*

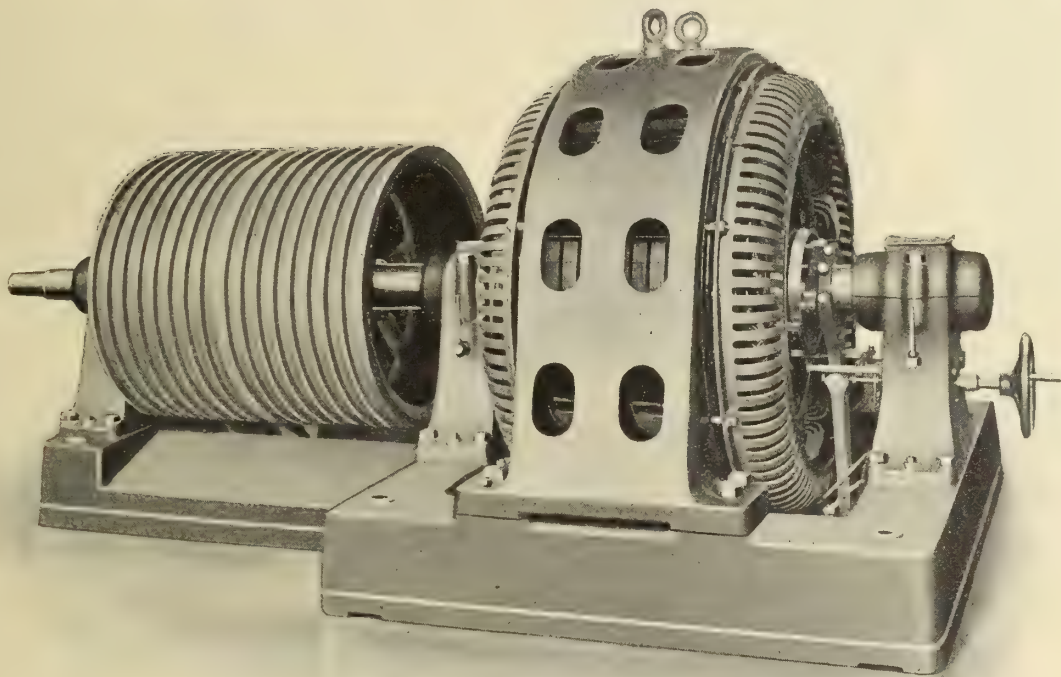
Head Office: Toronto. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert



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350 H.P., 3 phase, 25 cycle, 2200 volt, three bearing, Slip Ring Type Induction Motor for rope drive.

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Electrical Equipment*

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**EUREKA****Reduced \$5.50**

The inimitable Eureka portable vacuum cleaner (like the Ford automobile) has become so popular that a substantial reduction in price is possible. \$5.50 reduction.

The Eureka is light and easily operated and it has tools for cleaning everything in the house. The motor is made specially for the purpose in our own factory, and will last a life-time.

**Eureka Retail Reduced Price is**

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East of Winnipeg \$39.50

Attachments \$10.00 extra.

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**Onward Mfg. Co.**  
Berlin, Ont.

# ***Announcement***

We are now ready to fill orders for the "Famous **EVEREADY** Products" from our new Toronto factory. All troubles heretofore experienced with weak or deteriorated flashlight batteries now eliminated. **EVEREADY** "Tungsten" (trade mark) batteries are known the world over as the best.

**FULLY GUARANTEED**

## **Canadian Ever Ready Works**

of Canadian National Carbon Co., Limited

**90 Chestnut Street**

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**Toronto, Ontario**

*Manufacturers of **EVEREADY** Flashlights and other types of portable lights, "Tungsten" Batteries, Dry Cells, Miniature lamps, Christmas Tree Outfits, Direct Current Meters, Pocket Meters.*



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A grave responsibility rests on the big men of every community. They are the leaders of public opinion. And public opinion makes or breaks a business, a city or a country.

Just now with the air filled with rumors the nervous grow more nervous and the responsibility of leadership grows heavier on those who are capable of bearing it.

Canada's soundness needs no argument with you. Canada's ability to weather this storm is not a matter of guesses or hopes—but one of facts and figures.

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*Northern Electric Company*  
LIMITED

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**Prompt Shipments**

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Factories at Windsor, Ont. and St. Louis, Mo.

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**THE LAMP YOU KNOW**

### **“CONDOR” LAMPS**

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We can give you prompt deliveries on all sizes.

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Sole Canadian Distributors:

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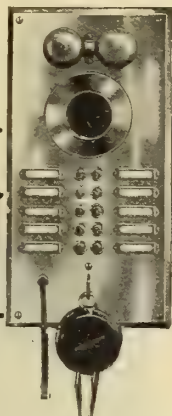
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Over twenty years of specializing on this class of work has made "Connecticut" synonymous with quality. "Connecticut" instruments not only wear well, but give efficient, lasting service.

*Highest  
Quality*

*Reasonable  
Prices*



**CONNECTICUT**

*Simple in  
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"Connecticut" Annunciators and Interior Telephones are made in a wide variety of styles and sizes. You can suit any customer. Write for Catalog 22C.

**Connecticut Telephone & Electric Company, Inc.**  
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## UNIFORMITY!

in mechanical strength, wearing quality, firmness of texture and lubricating quality, **every**

## "LE CARBONE"

(Made in France)

## Carbon Brush

in a million is absolutely identical.

This means that a type of **Le Carbone Brush** once installed to meet your conditions will always meet them on subsequent shipments.

*Le Carbone quality never varies!*

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## THE NEW ALKLUM ACCUMULATOR

### Special Advantages:

NO LEAD. NO ACID. NO CELLULOIDE CASE

#### Strength:

Cannot be hurt with overcharging or running down to Zero.

#### Size:

Smaller than any other Accumulator.

#### Life:

Ten times the life of Lead Accumulators.

#### Reliability:

The Voltage keeps practically the same all the time used.

#### Weight:

The Lightest in the World.

#### Convenience:

Having very wide charging rates.

Far in advance of any other Accumulator for Hand-lamps, because it can be left for any length of time without deteriorating. Absolutely the Best for Miners' Lamps, because it gives off the same amount of current the whole of the time it is in use, maintaining the light evenly throughout the day. Most satisfactory for Electric Self-starters. A great advantage over any other Accumulator for lighting cars.

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**WORSNOP AND CO., LTD.**  
LAMP WORKS, HALIFAX, ENGLAND.

Who are also the largest makers of Electric Motor Lamps in the World.

**GUARANTEED TO BE SUPERIOR TO ANY  
OTHER ACCUMULATOR IN THE WORLD.**

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## Open Tank Process

with the genuine

## Avenarius Carbolineum

Doubles the life of your poles

Completely fills the pores and cracks

Compared to our method, the brush treatment is a makeshift

The cost is reasonable

Three years additional life pays back first cost and thereby

Reduces annual cost appreciably

What will poles cost in ten years?

Then add the cost of replacing poles and arms

Our new plant at

Nakusp, B.C. is now in operation

GET OUR PRICES ON TREATED POLES

## The Lindsley Brothers Company

"Good Poles Quick"

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that your switch boxes should be waterproof, secure against tampering, and so constructed as to avoid danger in making connections.

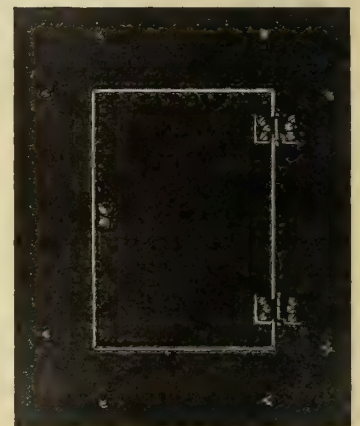
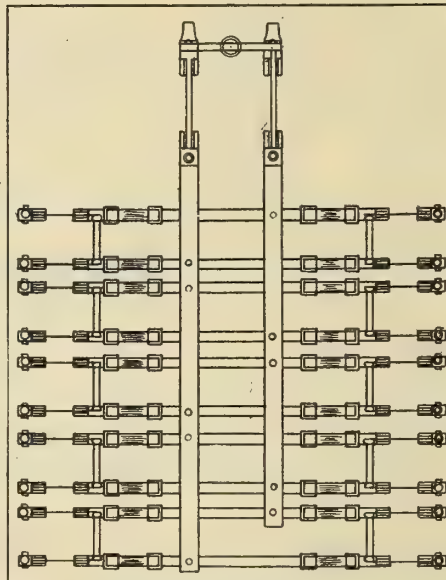
The D. & W. fuse switch boxes have passed all these tests successfully. They are fitted with rubber gaskets to render them waterproof. They can be permanently locked after fuses are installed, thereby making them secure against tampering.

It is impossible to re-fuse the circuit when the switch is closed.

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## PANELS

Devoe Panels are manufactured to meet every underwriter requirement. They are exceptionally strong and handsome, and are used and recommended by all leading Electrical Engineers and Contractors. We make Panel Boards to any specifications and can give you prompt quotations.

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## Wm. Wurdack Electric Mfg. Co.

19 to 23 South Eleventh St., St. Louis, Missouri

*Manufacturers of*

**Switchboards — Panelboards — Cabinets, Etc.**

We are in position to make up your special requirements at a low cost—Write us for prices before placing your next order.



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## **Conduit Engineer & Contractor**

*Head Office*  
**503 Power Building, Montreal, Can.**



## **Sundh Tank and Sump Switches. Rating**

30 amperes normal capacity at 115 and 230  
Volts A. C. or D. C.

15 amperes normal capacity at 440  
Volts A. C.

15 amperes normal capacity at 550 volts A. C. or D. C., but switch  
should be made double break in which case use 2 pole piece.

### **The most serviceable switches produced for Controlling Water Levels**

Sundh tank and sump switches are rugged in construction and  
reliable in operation. Have a snap action which unfailingly gives  
quick break. Absolutely weatherproof.

When double-acting this type of switch forms the most reliable  
high or low water alarm on the market.

*Write for Catalog and Prices*

**SUNDH ELECTRIC COMPANY**  
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**Let us say—That Nowhere  
nor at any Price Can You  
Get Better Quality  
Than That Which  
Has Made**



**Wires and  
Cables so  
Famous**

Large stocks are carried at Toronto, Montreal, Winnipeg and Vancouver from which we are able to make prompt shipments.

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Railway and Power Feeder Cables in Copper and Aluminum.

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Copper Clad Wire, Bare and Weatherproof.

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Immediate Shipment. Standard Package 25.  
Liberal Discounts.  
Complete with Hubbell Attachment Plug.

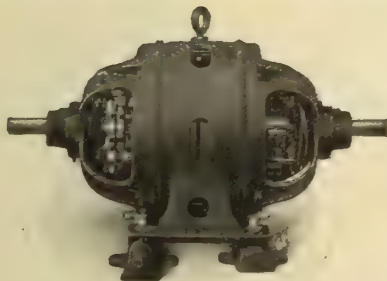
### R. E. T. PRINGLE

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MONTREAL TORONTO WINNIPEG

## Vehicle Battery Charging

is simplified, and the expense reduced, by the use of the

## Wagner Converter



A sturdy little device, that even a child can operate.

It is safe, reliable and convenient.

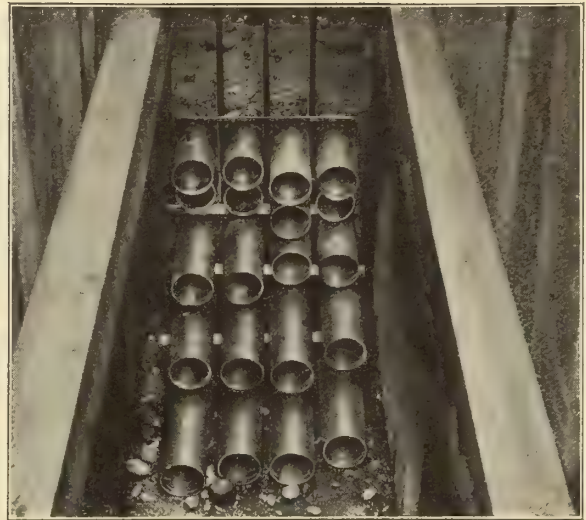
Its installation cost is its last cost.

Your car is always ready for use when you charge it at home.

*Bulletin 10313*

**Wagner Electric Manufacturing Company**  
of Canada Limited—Montreal

57 Guardian Bldg., 1222 Traders' Bank Bldg.,  
Montreal Toronto



Showing method of laying 100,000 feet of J-M Fibre Conduit in concrete at plant of Pittsburgh Crucible Steel Co., Midland, Pa.

## Big Steel Plant Selects J-M Fibre Conduit for underground lines

The Pittsburgh Crucible Steel Co. recently decided on underground distribution, after part of their overhead installation had been blown down. They chose J-M Fibre Conduit in preference to all others for the following reasons:

It is practically unbreakable—sustains a compression weight that would crush ordinary conduits.

It is practically everlasting—made of specially-treated fibre and protected with a bituminous compound.

It is proof against destruction by fungus, decaying vegetable matter, earthy salts, etc.

It is impervious to moisture, gases, acid solutions and other corrosive elements.

It possesses highest dielectric strength.

It has a smooth bore—no offsets, seams or roughness at joints to abrade cable coverings.

It weighs only one-sixth as much as tile or stoneware conduit. Therefore, reduces trucking expenses 80 per cent. Also saves time and money in laying.

These are the "reasons why" you should select J-M Fibre Conduit in preference to all others.

Write our nearest Branch today for Booklet.

## The Canadian H. W. Johns-Manville Co., Limited

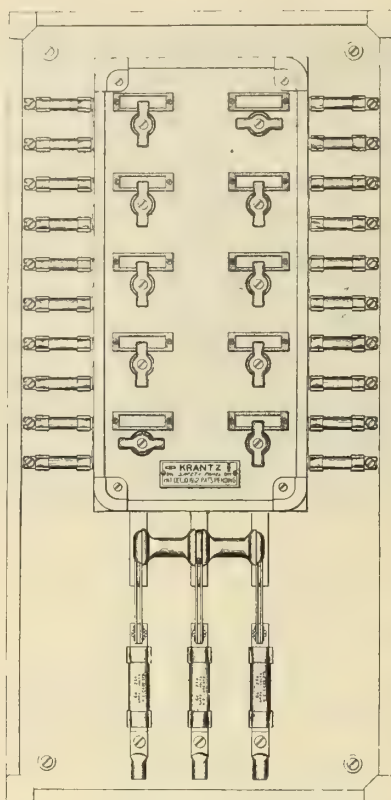
Manufacturers of Service, Subway and Transformer Boxes;  
Fuses; Line Material; Insulating Materials; Fireproof Wood;  
Friction Tapes; Dry Batteries; Lighting Systems; Etc.

Toronto  
Montreal



Winnipeg  
Vancouver





Krantz Safety Panel  
Without Trim

On the Largest Installations in  
Canada You Will Find the Name

# KRANTZ

on

## Panelboards and Switchboards

*We Manufacture*

Safety Panels, Metering Panels, Knife Switches, Switchboards of Standard and special designs.

The closest examination will convince you that our product is equaled by none although copied by many.

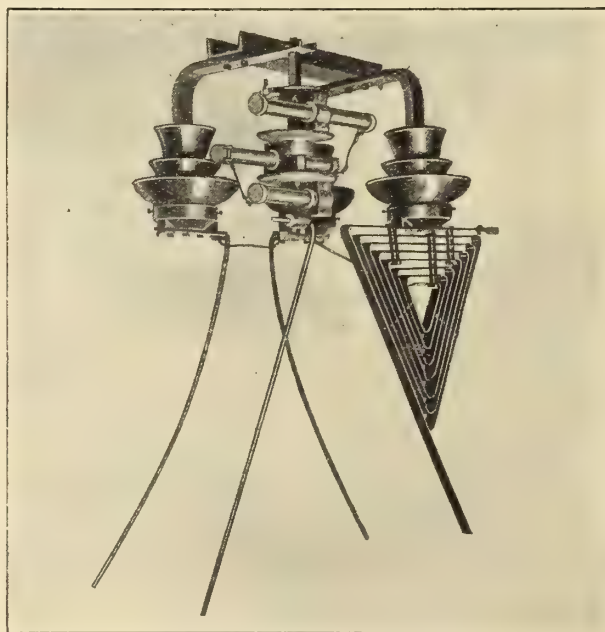
We are recognized leaders in switchboard and panel design and our engineers are at your service.

*Write for catalog No. 34, Jan., 1914.*

### The Canadian Krantz Electric and Mfg. Co., Limited

Head Office—67-71 Adelaide St. West, TORONTO

Branch Offices—Montreal, Winnipeg



Combination Burke Horn Gap Lightning Arrester Choke. Coil and Fuse.

## Lightning Arresters Burke Horn Gap Resistance in Ground

Circuit limits the flow of dynamic current which might otherwise follow a discharge to ground. The magnetic blow out aids in breaking the arc quickly.

Resistance Columns so built that they may be used with Burke Arresters now operating with horns connected direct to ground.

*Send for catalogue Burke Switching and Protective Apparatus.*

### Railway & Industrial Engineering Co., Pittsburgh, Pa.

CANADIAN AGENCY :— The Ferranti Electrical Co., of Canada Montreal, Toronto & Winnipeg

Address correspondence to Works Office, Greensburgh, Pa.



## Their Perfect Light Control Standardizes Eye Comfort Fixtures for Nitrogen Lamps

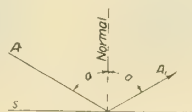
Eyes must be protected from the blinding brilliancy of the "Nitrogen lamp."

A most effective way of doing this is to conceal the lamp, and, by means of powerful X-Ray Eye Comfort reflectors direct the light against the ceiling at the proper angle, and evenly diffuse it throughout the room.

### A Word About Light Control

Without perfect control of the light rays, searchlights, auto, and locomotive headlights, etc., would be impossible.

Some of these accomplish light control by means of a lens, others use correctly designed mirror reflectors. You never see anything but a mirror reflecting surface used in any of these light is so essential,—nevered steel, never plaster or wood. is the only surface which re-against it at exactly the same surface, (see figure 1). This flection.



Substances such as porcelain, white or aluminum paint, wood, plaster, etc., are diffusely reflecting surfaces. Instead of reflecting rays at the same angle, the light rays are "sprayed" back, so to speak, the light being reflected at all angles. This diffusely reflected light does not travel in any single fixed direction and it cannot therefore be controlled.

All X-RAY Eye Comfort Reflectors are mirror Reflectors designed in strict accord with this first law of light.

Write for information on nitrogen lamp fixtures.

## National X-Ray Reflector Company

"Illumination from Concealed Sources"

Chicago  
225 W. Jackson Blvd.

New York  
6 East 39th Street

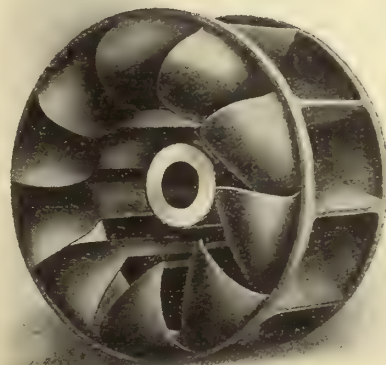
## The "Canadian" Turbine Water Wheel



A normal speed Turbine of normal capacity. Not overgated or over-rated. Steady, sturdy power from quarter to full gate.

Efficiency,  
Durability  
and Genuine  
Satisfaction  
assured.

Write for Catalogue  
No. 12.

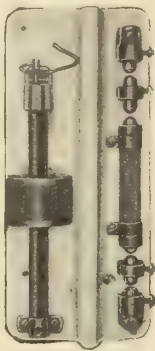


## CHAS. BARBER & SONS, Meaford, Ontario

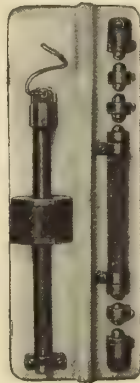
Established 1867



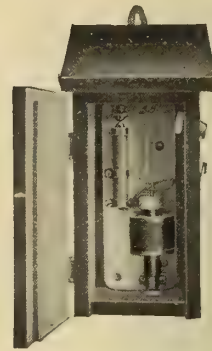
# You Must Use These Lightning Arresters



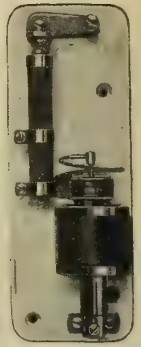
Arresters for A. C. Service 1200 to 2500 volts.



Arresters for A. C. Service 2500 to 3500 volts.



Arresters for D. C. Service 350 to 750 volts



## To Get Complete Protection

Only Garton-Daniels Lightning Arresters can offer you "complete" protection. Their small air gap distance, low series resistance and positive mechanical circuit breaker insure efficient protection, eliminate low voltages, winking lights, etc., and make grounds and short-circuits through the arrester next to impossible.

Don't forget that one flash can cripple your entire plant—cost you a lot of money—loss of power—kicks from the public.

Your apparatus is not protected without Garton-Daniels. Order yours now before the lightning comes.

### JOHN MILLEN & SON, LIMITED

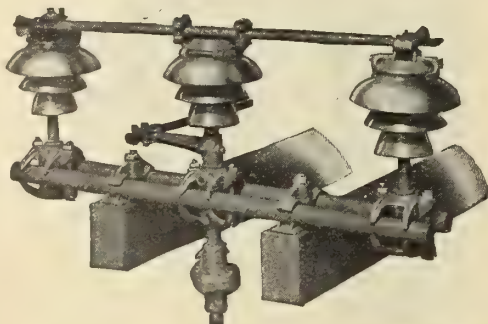
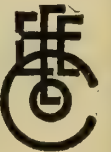
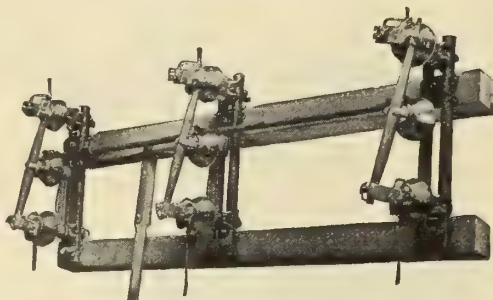
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Manufacturers  
PHILADELPHIA NEW YORK CHICAGO  
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**Power Station Layouts, Sub-Station  
Layouts, Switching Equipments**

Put your problems up to our Engineering Department. We supply all necessary materials.

Orders are shipped and billed the day received.

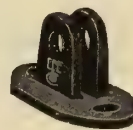
Our new bulletin No. 102 on Cable End Bells covers new types and revise prices. Mailed on request.

**Electrical Engineers Equipment Co.**

711-715 Meridian St., Chicago, Ill.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for \$2.00 per annum. United States and foreign, \$2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Authorized by the Postmaster General for Canada, for transmission as second class matter.

Entered as second class matter July 18th, 1914, at the Postoffice at Buffalo, N.Y., under the Act of Congress of March 3, 1879.

Vol. 23

Toronto, September 1, 1914

No. 17

## The War and Canada's Trade

Now that the more or less panicky feeling has considerably subsided, which this continent, in common with the rest of the civilized world, experienced when the declaration of war by the German nation was announced, and now that we are able to look the situation squarely in the face, it is generally conceded that there are many probable developments in connection with which Canadians may well feel hopeful and full of courage. Chief of these is the almost certain extension of her manufacturing and trade connections.

The eminent economist, Sir George Paish, takes the view that the present war will open up a tremendous opportunity for Canada and the United States. It is held that if the tide be taken at the flood it will mean not diminished, but greater, prosperity for us. Financial embarrassment may, indeed, be experienced for a time, but this is an evil which will be common to practically the whole world. With the maintenance of ocean traffic and the opportunity to dispose of our farm and factory products the speediest recovery will surely come to Canada. Activity in new lines will compensate for depression in others. Far removed, we trust, from the scene of hostilities, the internal trade of this country should suffer as little as any in the world.

\* \* \*

An examination of actual facts and figures cannot but be reassuring to the manufacturing and trade interests of Canada. We find that in the fiscal year ending March 31 last, our exports and imports represented a total value of

more than a billion dollars—the highest figures in our country's history. In this period a great stride was made in our exports, which amounted to nearly \$432,000,000. The amount of trade carried on with the present enemies of the Empire was inconsiderable, our exports to Germany and Austria-Hungary combined amounting to less than four and one-half million dollars, while our imports from these countries were about four times as great. It is questionable, therefore, whether it would not be in Canada's favor if the exchange of business were wiped out. Naturally the war will affect adversely the buying power of many European countries, but it must be remembered that our business with Continental Europe constitutes only a small part of our external trade, and that it is the other colonies of the British Empire, and the United States, that are our best customers. Canadian total exports to Continental Europe last year amounted to less than twenty million dollars, while our commerce with other parts of the Empire consisted of exports to the value of some \$239,000,000 and imports amounting to \$154,000,000—a total of \$393,000,000. With the United States, our trade consisted of exports amounting to \$200,000,000 and imports valued at \$411,000,000 a total of \$611,000,000. Thus our trade with other parts of the British Empire and with the United States amounts to upwards of a billion dollars. With these things in mind and the knowledge that Germany's merchant vessels are being driven off the sea, one may surely conclude that ultimately the war will have a good effect upon British (including Canadian) and United States trade. It is also reasonable to expect that much of the German competition which British and Canadian manufacturers have had to cope with in the past will be wiped out and that Canada will share in the transfer of the trade which Germany will lose.

\* \* \*

We must not, of course, overlook the fact that one of the most likely results of the war will be a world-wide scarcity of capital for investment purposes. It is impossible to foresee in detail the far-reaching results of the changes that are taking place in the value of capital, but a natural outcome is that constructional works and public improvements will be considerably delayed. Activity, however, will be all the greater when constructive enterprise begins its forward march. All the more necessary, then, for us to be prepared to take full advantage of it.

After the Napoleonic wars, one hundred years ago, it was not long before England was on the quick march to prosperity. Marked improvements took place in almost every branch of domestic industry; funds rose, revenue increased, manufactured lines were in great demand, money was abundant, sales of land improved, gold reappeared, and depression gave place to hopefulness and enterprise. We can glean encouragement from the pages which record the experience of other days.

\* \* \*

It is to be hoped that the great majority whose faith in Britain's, and with it Canada's, destiny is unalterable, will rise to the present emergency by united effort and preserve the internal stability of the Empire and her colonies. There is ample reason to believe that even with a continuation of the war for some time, there will arise new demands for industries to offset those that are cut off. From now on the factories of Germany and France, depleted as they will be by the call to arms, will scarcely be able to meet the demands of home consumption. Here, then, will be the opportunity for Great Britain, Canada and the United States, in which Canada should play an important part, all the more so in that we possess a wonderful variety of raw materials without going outside our own borders. Markets will arise in other parts of the British Empire, and these will be



strengthened by a feeling of great reliance in Canadian products. It is an ill wind that blows nobody good, and possibly one of the most marked benefits that will arise out of this terrible conflict will be the stimulus afforded the manufacturing industries of the North American continent. The cessation of imports from continental Europe into England and Canada will give many home industries an unexampled opportunity for immediate development on an enterprising scale. Canada has a home demand which must be satisfied, and, with the untold natural resources of the country, we can look with confidence to the supply from within. Much of the new trade will be held, and so Canada will prosper at the expense of her former continental competitors

\* \* \*

Already there is evidence that the normal channels of trade are being diverted towards Canada. Certain British manufacturers who have relied on German raw material are looking elsewhere for supplies. The Department of Trade & Commerce at Ottawa report numerous inquiries regarding Canadian resources and trade possibilities. Viewed as a cold money proposition it is probable that no other world movement could have been as immediately effective in bringing Canada and her resources so prominently into the limelight. For whatever it is worth at a time like the present, the financial advantage surely rests with us.

### Electrical Contracting a Profession

We ask special attention, particularly by electrical contractors and architects, to a typical and, as we believe, a model plan and specifications for the wiring of a private residence designed for the man of average means and which would be suitable for probably, the great majority of the houses of the present day. It will be readily conceded that far too little attention has been paid to the correct and scientific designing of the electric work in private residences. This has been due as much to the negligence of electrical contractors themselves, who are sometimes incompetent, as to architects, who naturally are not in a position to appreciate to the fullest extent the value of a proper wiring installation. The architect's training fits him to design either artistic or convenient houses or a combination of both and naturally he cannot be in touch with the exquisite refinements of modern electricity any more than the electrical engineer can be expert in artistic design. There is not, however, the same excuse for the electrical contractor.

That electrical installations in buildings of all sorts are worthy of the attention that is latterly being paid to them is amply attested by the people who have experienced the conveniences and luxuries of a modern scientifically laid out system. The demand for it is further shown by the number of consulting electrical engineers who at different points throughout the Dominion are specializing in the design and oversight of the work of the electrical contractor. A few weeks ago we published a complete set of plans and specifications prepared by one of these firms of consulting engineers having special reference to an office and warehouse building of the larger type. The general interest created by this article is the direct cause of the publication of a similar article in the present issue on the plans and specifications for a private residence. We believe this article contains valuable and helpful suggestions for every electrical contractor operating in Canada whatever his training or experience may be. Quite possibly there are a few who will be of the opinion that the article over-elaborates the subject of electric wiring. We do not think so. The only argument that can be advanced against any of the little refinements used, is expense; yet the electric work in this house

would not mean more than, at most, 2½ per cent of the total cost of the building.

When the day arrives that the architect or owner realizes that his electric installation is of sufficient importance to have definite plans and specifications drawn up along lines similar to those detailed in this article the work of the electrical contractor will be facilitated almost beyond conception, a big advance will have been made towards standardization, the work of the inspector will be infinitely reduced and the householder will have a reasonable guarantee that the installation he is paying for will fulfil adequately the purpose for which it is designed.

### Wooden Pole High Tension Lines

Reference is made elsewhere in this issue to the erection of an "A" frame wood pole construction transmission line which will carry 100,000 volt energy and the same item states that at the present time the company making the installation have in operation both a 60,000 and an 80,000 volt line. This is exceedingly interesting in view of the fact that it has generally been taken for granted that above voltages of 50,000, or at most 60,000, wooden poles were useless for transmission lines and could only be replaced by steel towers. Doubtless the life of the wooden tower line will be a consideration, but with modern methods of preserving wooden poles and considering also that changes in the art of high tension transmission have so far always required changes in tower line construction before the limit of the line's life has been reached, it is evident that the wooden pole is a contending factor in high tension transmission.

In this connection an interesting statement was made by Mr. Chas. E. Waddell in a recent discussion, before the A. I. E. E., of a paper on the subject "High Tension Transmission Lines." Mr. Waddell is quoted as follows: "As to the question of grounded steel towers versus wooden supports, I confess that at the present state of the art I am leaning back toward wooden pole construction with wooden arms and non-grounded fittings. I have in mind a line where a steel tower line is paralleled by a wooden pole line, both 60,000 volts, from the same transformers. The wooden pole line is of standard conventional cross-arm construction with pin type insulators. The steel tower line is equipped with suspension insulators. The interruptions on the suspension insulator line have been too numerous to count while the wooden pole line has yet to have its first interruption."

### U. S. House Passes Water-Power Bill

The so-called Adamson bill, relating to the construction of dams across navigable streams, was passed by the House of Representatives of the United States on August 4. In accordance with its requirements, plans and specifications for such dams must be approved by the Secretary of War and the Chief of Engineers before work of construction is commenced. Approval may include the condition that water-power to operate locks, etc., be supplied without cost, or a reasonable annual charge may be made for the benefits that accrue to the grantee by the authority given under the act. The dam shall be so located as to be best adapted to a comprehensive plan for the improvement of the waterway for the use of navigation and for the full development of the water-power. The rights granted under the act extend over a period of fifty years beginning on the date of the original approval. Upon two years' notice prior to the expiration of the grant the United States has the right to take over the property of the grantee necessary and useful for the generation, transmission and distribution of energy, the payment therefor being based on the actual cost of the lands pur-



chased and used by the grantee and the fair value of the other properties taken over. Allowance will be made for deterioration but not for good will or profit in pending contracts. The Secretary of War is empowered to prescribe reasonable rates of charges for energy transmitted in "interstate or foreign commerce." When the energy is used within a state having adequate regulation for rates and service to the consumer the Secretary of War will not interfere with the established rules for rates and service.

### Treating Employees Right

As illustrating the generous treatment by electrical (and other) Canadian companies of such of their employees as are enlisting for war service, the following bulletin just issued by Mr. J. S. Norris, general manager and secretary-treasurer of the Montreal Light, Heat & Power Company, is typical:—

The management is pleased to announce that employees of the permanent force enlisting for active service under British Arms in First Canadian Contingent will retain their status as employees as regards Pension Fund and all other benefits with allowance of difference in pay between Government rate and present wages from date of enlistment to date of discharge or death (not exceeding one year) provided in the former case enlistment and discharge papers are submitted to the company promptly after disbandment of contingent. If desired accrued pay as above will be paid fortnightly to employees' dependents on order. Special bulletin will issue in the event of organization and dispatch of further Canadian contingents.

### Overseas Trade Practically Normal

Contrary to fears expressed in the early hours of the present European war the avenues of trade in Canada and Britain have been kept practically clear of danger. Shipments have continued almost as usual and unless unforeseen difficulties arise there is little danger that the Canadian market will suffer from the inability of the British manufacturer to deliver his goods. Already the situation has adjusted itself to the extent that insurance rates have become almost normal and a number of shipments have arrived during the week. The present indication is that British manufacturers will suffer chiefly from the lack of raw materials, but several firms report ample supplies for many months to come. That Britain should be engaged in a death grapple with Germany and at the same time be enabled to carry on without molestation her over-seas commerce, is one of the most striking incidents of this unparalleled situation.

### Ten Commandments of Safety

At the Lorain Steel Company's plant at Johnstown, Pa., the following ten commandments have been adopted for the guidance of the employees:

1. Thou shalt have no other thoughts than thy work.
2. Thou shalt take no unnecessary risks, nor try to show off, nor play practical jokes, for by thy carelessness thou mayest do injuries which will have effect unto the third and fourth generations to follow.
3. Thou shalt not swear, nor lose thy temper when things do not come just right.
4. Remember that thou art not the only one on the job and that other lives are just as important as thine own.
5. Honor thy job and thyself that thy days may be long in employment.
6. Thou shalt not clean machinery while it is in motion.
7. Thou shalt not watch thy neighbor's work, but attend to thine own.

8. Thou shalt not let the sleeves of thy shirt hang loose, nor the flaps of thy coat be unbuttoned, as they may get caught in the machinery.

9. Thou shalt not throw matches or greasy waste on the floor, nor scatter oil around the bearings, as a dirty worker is a clumsy worker, and a clumsy worker is a menace to his fellow workers.

10. Thou shalt not interfere with the switches, nor the dynamos, nor the cables, nor the engines, nor anything else thou art told is dangerous.

### Interesting Service Decisions

The following interesting decision regarding service relations has been handed down by the New Jersey Public Utilities Commissioners as reported in "Rate Research" published by the Rate Research Committee of the National Electric Light Association. The complaint of one Max Taub against a public service electric company based upon the refusal to furnish service was dismissed.

The company refused service because of the failure of the complainant to provide for the grounding of transformer secondaries inside his own premises as required by the company's rules. The decision reviews expert testimony in regard to the grounding of secondaries of transformers, the object of grounding, objections to grounding, methods of grounding and the most approved method.

The board states that after extended investigation the Board entered an order effective January 1, 1914, putting into operation "Rules, regulations and recommendations for electrical supply utilities and for all utilities owning and using poles and wires."

This order, which is still in effect, provides among other things that—

"XIV. The rules contained in the 1913 edition of the National Electric Code regarding grounding of secondaries are hereby adopted for all new connection. . . ."

The order is general. The rule laid down by it is applicable to all companies under the jurisdiction of the Board.

The rules contained in the 1913 edition of the National Electric Code regarding grounding of secondaries, and adopted by the Board are found in Section 15. In so far as they are pertinent they are set forth in the decision and the Board finds that the Company's rule is in accord with the order of the Board.

It is urged by the complainant that the cost of the inside ground wire should be borne by the Company, and not by consumer. In considering the complaints of Fernando W. Meyer and Joseph McBride, the Board concluded that the house wiring included the running of the inside ground wire, and the cost thereof should consequently be borne by the consumer. The present record discloses no reason for changing this conclusion.

#### Electrolysis

The possible detrimental effects of making such connections upon the City's system through the action of electrolysis was considered. Expert opinion is quoted as follows:

"Alternating current, of a frequency as is used for electric light and power for buildings in Hoboken, \* \* \* is current which reverses in direction one hundred and twenty times every second. When such a current flows between an iron pipe and surrounding soil, there is only a negligible effect from electrolysis." . . .

"\* \* \* the practice has been followed in so many places without any case of injury to the water pipes being detected that objections of this sort can easily be shown to be unreasonable."



The National Electrical Code (ed. 1913), too, contains this note (p. 29):

"Companies and Departments in charge of water works are urged to allow the attaching of ground wires to their piping system in full confidence that the integrity of such piping system will not in any way be affected, whatever may be the normal voltage."

After full consideration of the case, the Board dismissed the complaint.

#### BREAKDOWN OR AUXILIARY SERVICE

This is a decision of the New York Supreme Court reversing a previous decision of the Public Service Commission that the New York Edison Company is justified in not furnishing certain auxiliary service. The court holds that the company's reasons for refusing to furnish electric current are untenable and that the restrictive clause which it insists on inserting in this contract, and to which objection is taken by the customer, is contrary to public policy and invalid, and constitutes in no proper sense a reasonable regulation respecting the use of the service demanded.

#### Refusal of Service

The decision cites that the New York Edison Company is a public service corporation holding a franchise from the city and enjoying valuable privileges not generally granted to a private individual or corporation for its own individual benefit, not the least of which is the right to use the public streets and highways for carrying its conduits. Having undertaken to perform a public service and accepted certain provisions in connection with the undertaking it is bound to serve impartially every member of the community who demands this service and stands ready to pay therefor and to comply with proper and reasonable regulations respecting said service.

Not only is the company under this obligation by the common law but it is expressly required by statute to furnish electricity for light upon the application of the occupant of any building or premises within 100 feet of its mains or wires, as it is conceded that this would-be customer's premises are. The same duty is imposed by the Public Service Commission's law. The Supreme Court of the United States has said "that a public service company must render the service for which it obtained its charter to those within reach of its facilities without distinction of persons."

It is urged by the company and apparently agreed to by the Commission that the company in any event is not obliged to furnish electricity for power and refrigeration purposes. In the opinion of the Supreme Court of the United States the company's duty to furnish service, however, does not rest upon the statute alone but upon the common law obligation as a public service corporation, which requires it to serve impartially every member of the community. It may be that if it did not undertake to furnish electricity for power purposes to any one it could not be coerced to do so. It does, however, profess to undertake to furnish electric current for power purposes and this it does by virtue of its franchise as a public service company. So professing and undertaking, it cannot arbitrarily pick and choose whom it will serve and whom it will not.

#### Terms and Conditions

It is, of course, the rule that such a corporation may establish reasonable regulations respecting the use of the service which it proposes to furnish, and each customer requiring the service is called upon to comply with such regulations. In our opinion, however, the requirement that a consumer must take all of its electricity from one company, or receive none at all, is not in any proper sense a regulation respecting the use of the service, but is a purely arbitrary

attempt on the part of the company to insure to itself a monopoly of furnishing electrical current. If the company can lawfully decline to furnish any current to this relator because he also proposes to obtain electricity from a neighbor (not a competing company) it can equally well refuse to furnish electrical current to a consumer who himself generates a part of the current which he uses. Such a limitation upon the company's obligation would, as it seems to us, be quite unreasonable.

#### Limited Hour Service

An attempt, not thoroughly successful, was made before the Public Service Commission to establish the fact that relator sought to use the company's current only during those hours that it would be most expensive to produce it. If that be so, the situation could be readily met by establishing a rate for such service; but it is probably not so, for it surely must be that a very large proportion of the company's customers use electricity only at night and not at all in the daytime, and yet no one would say that it would be reasonable for the company to refuse to furnish current unless the customers would undertake to use it during the whole 24 hours of each day.

### I. E. S. Convention Program

The following list of papers will be presented at the convention of the Illumination Engineering Society, Cleveland, Ohio.

Factory Lighting—By Hogue and Dicker.

Some Experiments with the Ferree Test for Eye Fatigue—By J. R. Cravath.

Planning for Daylight and Sunlight in Buildings.—By Marks and Woodwell.

Notes on the Ulbricht Integrating Sphere and Arc Lamp Photometry—By H. K. Chaney.

Effect of Room Dimensions on Efficiency of Lighting Systems—By Ward Harrison.

Relation of Light to the Critical Inspection of Documents—By A. S. Osborne.

Experiments with Colored Absorbing Solutions for Use in Heterochromatic Photometry—By H. E. Ives and E. F. Kingsbury.

A New Standard Light Source—By L. A. Jones.

Artificial Daylight—Its Production and Use—By M. Luckiesh and F. E. Cady.

Characteristics of Gas-Filled Lamps—By G. M. J. Mackay.

A Transmission and Absorbing Photometer for Small Areas—By Nutting and Jones.

Recent Improvements in Gas Lamps—By a Welsbach Representative.

Illumination of Light Shafts—By C. H. Sharp.

Portable Mine Lamp—By H. H. Clark.

Some Recent Experiments on Vision in Animals—By H. M. Johnson.

Light Filters for Use in Photometry—By C. E. K. Moes.

The Locomotive Headlight—By J. L. Minick.

Present Practice in Machine-shop Lighting—By Powell and Harrington.

The Development of Daylight—By E. J. Brady.

Lighting of the Home—By a Representative of The Duquesne Light Company.

Lighting of a Carpet Mill—By Rose and Ockley.

Color Variation in Illuminants—By Jones and Nutting.

Reflection Standards—By Nutting and Jones.

Physiological Effects of Light on the Body—By E. C. Titus.



# Another Plant on the Montreal River

At Fountain Falls, in the Cobalt district—Same water used three times over—Northern Ontario a happy combination of mineral wealth and water powers

By H. E. Mueller

In the latter part of May, 1914, the generators at the new Fountain Falls station of the Northern Ontario Light & Power Company were paralleled with the line, on which were the Ragged Chutes, Hound Chutes, and Matabitchouan River plants, and have since been operating with these plants, supplying the Cobalt mines and surrounding towns with light and power.

This station is situated on the Montreal River,  $1\frac{1}{2}$  miles below the Ragged Chutes air and electric, and four miles below the Hound Chutes hydro-electric plant, all on the Montreal River.

## The Power House

The sub-structure of the power house is a combination of Cyclopean and reinforced concrete. The super-structure, 26 by 66 ft. in plan and 78 feet high, is a steel frame, with reinforced concrete walls and tile roofing, covered with tar and fine pebbles, and is equipped with a 20-ton travelling crane, with electrically operated hoist. Ninety steel frame windows, with wire reinforced glass, operated from the generator floor, together with a large ventilator on the roof, give the power house all necessary light and ventilation.

At the north end of the generator floor is located the

switchboard and motor-generator exciter sets. Directly above the foregoing is the oil switch and disconnecting switch gallery, over which is the lightning arrester and transformer gallery. Electrically operated field rheostats for the alternators are also on this gallery.

## Electrical Apparatus

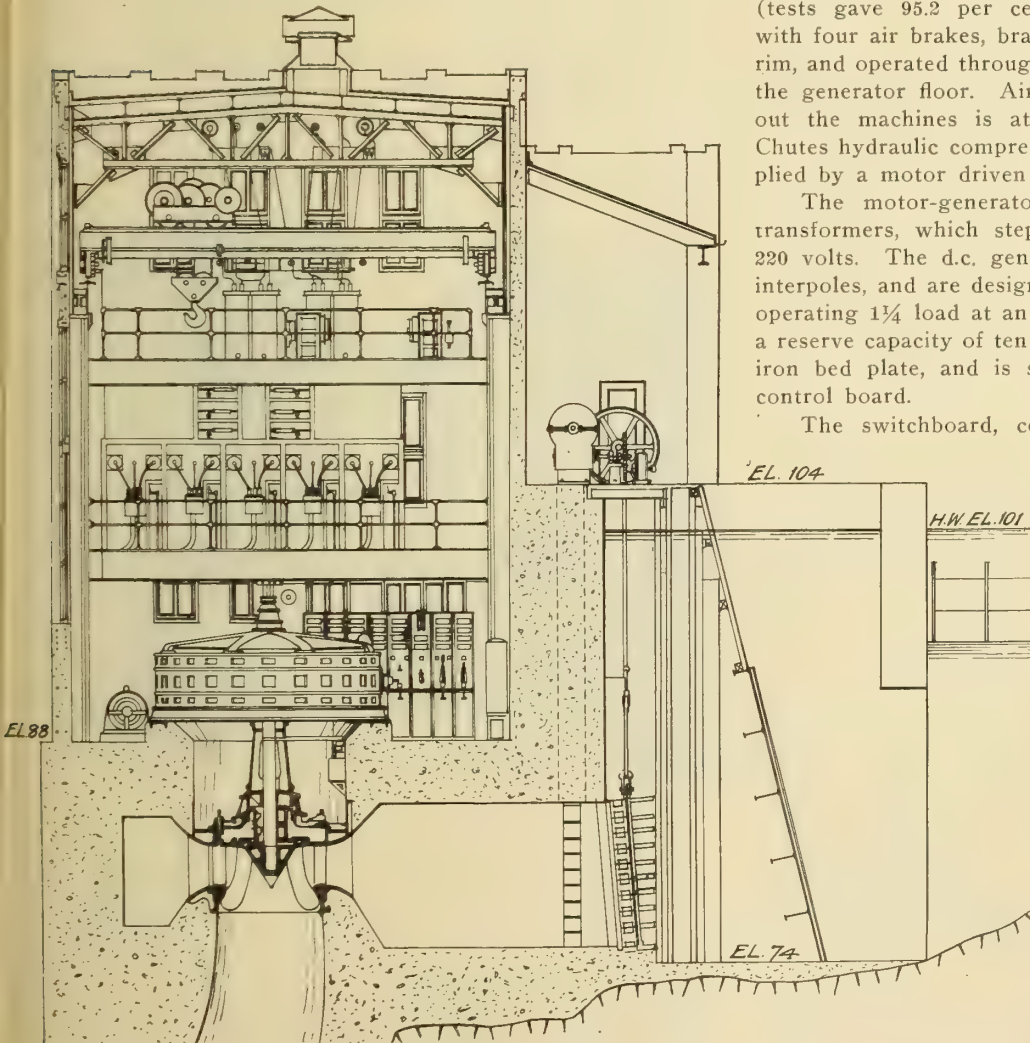
The electrical apparatus consists principally of two vertical type, revolving field, 3-phase, 60 cycle, 150 r.p.m., 11000 volt, 1250 kv.a. alternators; two 52 kw., 1200 r.p.m., 220/125 volt, 3-phase, 60 cycle, motor-generator exciting sets; four 40 kv.a. oil insulated, self-cooled, single-phase, 60 cycle, 11,000/230/115 volt transformers; an eight-panel switchboard and necessary switching equipment. These were all supplied by the General Electric Company of Sweden.

The generators are equipped with one guide bearing above the revolving field, and a thrust bearing mounted on top of the generator frame which carries the total weight of the revolving element. Oil is circulated through the thrust bearing by a pump located in the generator pit and driven directly from the generator shaft. The efficiency of these generators at unity power factor, and full load is guaranteed by the manufacturers to be at least 94.5 per cent. (tests gave 95.2 per cent.). Each generator is equipped with four air brakes, braking on the lower side of the rotor rim, and operated through a motorman's air valve located on the generator floor. Air for these brakes and for blowing out the machines is at present supplied by the Ragged Chutes hydraulic compressed air plant, but will soon be supplied by a motor driven air compressor in the station.

The motor-generator sets are fed from the station transformers, which step the generated potential down to 220 volts. The d.c. generators are compound wound, with interpoles, and are designed to supply both generators when operating  $1\frac{1}{4}$  load at an 80 per cent. power factor and have a reserve capacity of ten kw. Each set is mounted on a cast iron bed plate, and is situated directly to the left of the control board.

The switchboard, consisting of eight panels of dark grey marble, is equipped with all necessary meters, oil switch operating levers, receptacles, plugs, etc., for synchronizing either generator with the bus or the bus with the line, and with push buttons for the electrically-operated field rheostats and the motors on the governors.

The three-pole oil switches are self contained, each set located in a reinforced concrete chamber. Directly behind the oil switches are the disconnecting switches and three-phase potential transformers. Each disconnect is separated from its neighbor by a concrete barrier. Below the disconnects is the potential transformer for that circuit, in another concrete

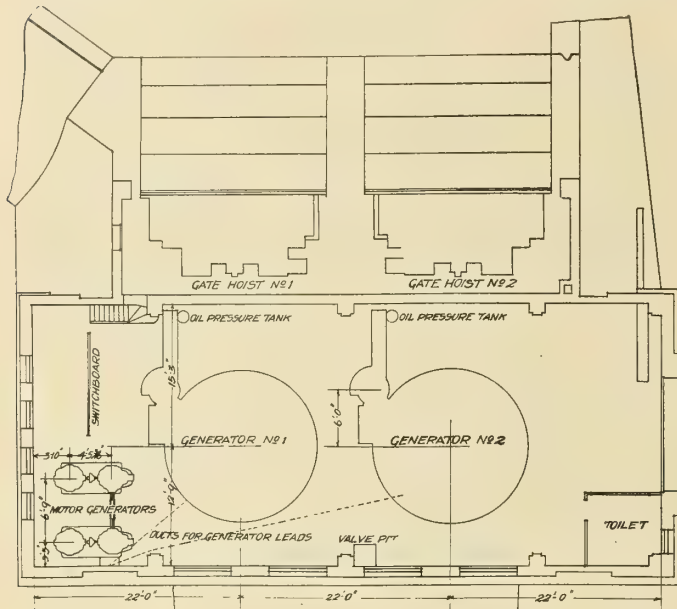


Section hydro-electric development plant, Fountain Falls, Montreal River.



chamber. Each set of disconnect barriers is numbered, named and colored differently. Numbers corresponding with those on the switch barriers are on each oil switch operating lever at the switchboard and are only visible to the operator when the oil switch is open. It is thus hardly possible to unknowingly open a loaded disconnect.

The bus bars are mounted in three separate concrete compartments, and are located above the oil switches and



Section showing Fountain Falls layout.

disconnects. A line feeder and a generator feeder are on one side of each set of bus sectionalizing switches, of which there are two, and the transformer taps are in the centre, with the sectionalizing switches on each side.

The lightning arresters are of the electrolytic type and were supplied by the Canadian Westinghouse Company.

### Water Wheels

The turbines, designed and built by the I. P. Morris Company, are of the Francis single runner, downward discharge type and are set in a reinforced concrete scroll case chamber, having draught tubes moulded in the concrete.

The runners on these wheels are an exact reproduction, on an enlarged scale, of the I. P. Morris experimental runner, which tested out 90.05 per cent. efficiency at the Holyoke Water Power Company's test flume.

Each wheel, equipped with a lignum vitae guide bearing and a water strainer for cooling same, is rated at 1500 h.p. when operating under an effective head of 30 ft. and is guaranteed to operate at at least 87 per cent. efficiency at full load.

### Governors

The speed is regulated by Pelton Type "G" oil pressure governors, shaft driven from the generator shaft and direct connected to the turbine gates. Each governor is equipped with a tachometer and a motor for distant speed control.

The thrust bearing oil pump, and the lignum vitae bearing strainer are both fitted with alarms, in case either should stop or choke up. When this happens an alarm bell rings and a signal lamp lights up on the corresponding generator panel. When a unit is shut down, the alarm bell is automatically cut out on opening the generator switch, and the signal lamp left burning.

### Head Gates

The gate house, directly adjacent to the power house, contains the motor-driven head gates, stop log slots, and

racks. Ten feet ahead of the racks is a concrete wier wall, extending nine feet below the operating water level which prevents ice and logs that get past the booms in the river, from coming up against the racks.

The head gates, 9 ft. 8 in. x 14 ft. 8 in., and weighing approximately 15 tons, are operated by induction motors. The bearing surface of these gates is on steel rollers, linked together, rolling on two steel rollers at each end of the gate. The gates seat in a bronze slot, and leak very little water. These gates will close and seat properly when the water wheel is operating with a full gate.

The above features were designed by Viele, Blackwell & Buck, New York, consulting engineers in charge of the whole development, and are giving perfect satisfaction.

### Illumination of Plant

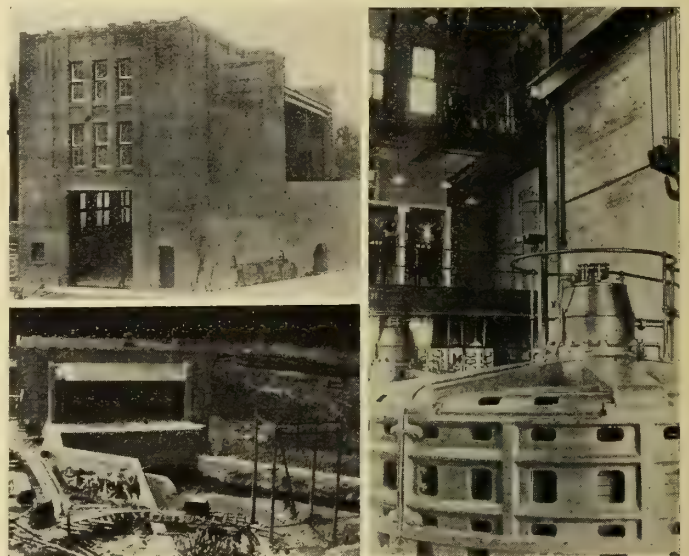
The power house is illuminated throughout with tungsten lamps. Five 250 watt lamps are used to light the main portion of the generator floor. Twelve 40 watt lamps, in a reflector, concealed behind a steel girder supporting the oil switch gallery, illuminate the switchboard perfectly. The rear of the switchboard, oil-switch and arrester galleries and gate house are excellently lighted with 100 watt lamps.

### The Dam

The dam is of the Ogee type constructed of a combination of Cyclopean and reinforced concrete. It is 400 feet long with an average height of 12 ft. and a maximum height of 15 ft., to which will be added four feet of flash boards. The dam, as well as the balance of the development, rests on solid rock throughout.

### Operation

From the description of the electrical apparatus it will be noted that this station is not "self starting," i.e., it depends on some outside current, for its initial field current for one machine. The following operations are, therefore, necessary to put one machine on the line. First, a line feeder is closed (supposing the sectionalizing and other necessary disconnecting switches to be closed) which puts



Exterior and interior views, Fountain Falls hydro-electric development plant.

the line potential, from the other stations, on the bus. The transformer switch is then closed, followed by the low tension bus knife switch, on the power panel, an exciter set started up and the alternator excited and paralleled with the bus bars. To avoid going through these same operations whenever any line trouble might open an oil switch the line switches have been set to go out first. The alternators are then exciting themselves, through the station transformers,



and it is only necessary to synchronize the bus with the line and either or both units will be ready for the load.

The load consists chiefly of induction motors, generally working at full capacity, which gives the station a power-factor of 78 per cent. more or less. Several 1,000 h.p. induction motors will soon be replaced with synchronous motors, which will be operated with an over-excited field, to boost the power factor. The operators at each station are informed from the Cobalt sub-station, which is nearly the centre of distribution, of any remarkable change in the power-factor, which is generally around noon and 4.30 p.m., and they adjust their fields accordingly. In this way, the power-factor at each station is kept nearly the same.

The transmission line for Fountain Falls was simply extended from Ragged Chutes. The entire line is of single

wooden poles, with two complete power circuits and two telephone lines. Each conductor is marked at every station and line tower, so that in case of several conductors breaking, a combination can be made of both lines, to get one complete circuit until such a time as the broken lines can be repaired. Up to date, however, it has never been necessary to take advantage of this feature.

The governors at this station have been set more sensitive than at any of the other plants with which it operates and as a result the Fountain Falls station responds to, and takes care of all light load changes. Recently a heavy load suddenly dropped off the line, and the one generator, then in service here, operating at the time with a full gate, dropped all its load and motored to the extent of nearly 300 kw., which kept the frequency practically normal.

# Need of the Electric Vehicle Industry

**is Standardization—Then will follow in natural sequence, Economical Production, Lower Prices, Larger Output—The last two items especially interdependent**

Henry Ford may well attribute the success of his immense business to the one-model idea. "The best little car for the money" arrived only through sticking to one standardized design and backing that design by quantity production of a magnitude that is almost unbelievable. The whole success of the automobile industry has hinged on production. Without it we would have had retail prices sufficient to retard our present "one million, plus" registration for another decade.

Without venturing to predict what effect quantity production would have upon the electric passenger vehicle, we do not hesitate to state that quantity production is the greatest immediate need of the electric truck.

The older manufacturers have reached a standard design which is accepted as practical by all really familiar with the needs of road transportation. The operating efficiency of the high grade electric truck is no longer questionable; neither is the fundamental superiority of the electric over the gasoline truck in the former's economic field. The development work has been done. What we now need is standardization and production on a large unit basis.

It is one of the anomalies of the industry that many competent engineers, purchasing agents and general managers will pass by the standard model at a fair price and insist on a truck built to their own specifications. Not every manufacturer will humor them (for eliminating the demands of certain trades and a small percentage of unusual operating conditions, that is all it amounts to) but if they can get their ideal of a good truck manufactured at all they are often willing to bear the big premium and the long wait in delivery which this entails. The special truck is frequently less of an operating success than the standard model would be, but that in some cases appears to be a secondary consideration.

## Buyers Not Wholly to Blame

But perhaps the prospective buyer is not wholly at fault. Let a new manufacturer of electric commercial vehicles come into the field and what do we find? In many cases that the "talking point" of the new vehicle is a new species of drive, a different arrangement of motor or battery, or some other kink in assembling the working parts. There is nothing that is fundamentally new or superior, except in minor details, to existing apparatus; nothing which adds to greater operating efficiency. In the last analysis, the new comer is just a little "different" from vehicles already in the field.

It may be necessary for the progress of the world to let the individuality of the inventor or designer find expression,

but from a cold blooded commercial standpoint, it is often wiser to let well enough alone. We cannot blame the prospective buyer of the electric for insisting on special chasses and freak bodies if these things largely obtain in the industry proper. What leaves a sting is this: every new model or design which comes out, especially where it is built just to be different from prevailing types, serves to confirm the contention of the "knocker" who claims that the electric vehicle industry is still in the development stage; that the electric truck, while showing great improvement is still an experiment—unstandardized and wanting in qualities which make for rapid adoption and national use.

The electrical industry has so many ramifications that there must be a period of development always with us with respect to apparatus designed to meet the need of some trade recently a convert to the electrical principal of propulsion or what not, but it does seem as though in the electric commercial field we might be saved from theories which are obviously wrong; from the so-called new ideas and principles which sound engineering discarded a decade ago. The pioneers in the industry have gone through all these things and have paid the price in money and in experience.

## Assets vs. Liabilities

Competition among strong firms building standard vehicles based on sound engineering lines will always be an asset to the industry, especially if the product is marketed on a one-price basis, while vehicles of "talking point" design, every other one of which either has a special chassis or is sold at an introductory price, are a liability. It is a crying shame that the industry as a whole should be retarded by the blind ambition, misdirected energy or whatever is the proper mild term, of individuals who ignore the history of business in general and who really know better at heart. One can make water run up hill but 99.9875 per cent. of water will always run down hill. Why can't people take the obvious for granted occasionally and at least begin their experimenting where the other capable chap left off?

Brown & Sharpe might build a wheel barrow to sell for \$50.00 but neither ball bearings nor their splendid reputation would make it a commercial success. There is no market for it. A difficult engineering feat in itself establishes nothing in a machine designed for general utility; it is simplicity which makes for economic production and economic use.

It is a mistake to assume that anything radically new is needed immediately in the electric vehicle industry. What



we need, as before stated, is production. Even refinements on existing designs can wait for production in sufficient units to reduce the initial investment to the buyer. With quantity production will come sales which will support the better adjustment of engineering details on existing designs and the development of apparatus better adapted to special needs.

### Staple vs. Specialty

It is absurd to suppose that the manufacturer can afford to develop a combination ice and coal truck before he has standardized a two-ton vehicle which can be used with equal success by the wholesale grocer, the express company, the textile mill and other large users of that capacity vehicle. It isn't good business to put the specialty ahead of the staple, or even to give it the same attention until profits from wide distribution have made possible the all-round development essential to a complete line.

Did you ever go to your friend, the underwear manufacturer, and ask him to put through half a dozen special union suits for you? Had to wait about three months and pay double, didn't you? And that is only half the story. That order was only put through as a matter of friendship and it cost the mill all the way from \$20.00 to \$200.00 to do it. The superintendent tore his hair the minute he saw the order. The fabric in question had to be put on a spare machine at great expense. Each garment had to have red silk marking threads run through it and be watched from room to room, mixing up the miles of standard tubular fabric, "balling up" the cutting room, confusing the stitchers and causing trouble generally. You can be sure you were the most popular man for miles around all the while your specials were outside of the express office.

And the same principle is involved in building a special truck in a well regulated factory of large production. No matter what price (short of perhaps \$10,000.00) was charged for it, the maker would lose money, and disrupt his manufacturing organization. The chances are, too, that as standard jigs and fixtures cannot be utilized the vehicle will suffer in high grade workmanship. Even things built by hand are not always perfect. Move the steering wheel six inches to the left and you must modify the steering mechanism. Widen the frame and about everything which supports the working parts will be short. Raise the battery box and you will need larger wheels or find it necessary to build a special "short" battery to go inside the frame and be content with a "hump" in the body. Lowering a battery normally placed above the frame would be equally expensive. Extra overhang on frame means abnormal weight on rear wheels and often 100 per cent. greater wear on tires. And so on indefinitely. Good engineering recognizes physical laws and to go against these costs money, and in a truck, decreases efficiency.

### "Can't Have Your Cake and Eat It, Too"

For example, the worm drive in a 1,000-lb. wagon is a big success, but before we can have a five-ton worm driven electric truck which is a success at 7 miles per hour, we must have a greater driving reduction than has yet been produced. The worm so far shows greater efficiency at a higher speed than experience has demonstrated a five-ton electric should run to be an economic success. So there you are. Or take the speed question. In a two-ton truck one can have 15 or possibly 18 miles an hour for two hours or 9 or 10 miles per hour for up to six hours, with the same amount of "juice." One can get either high speed or unusual mileage from the one battery, but not both!

There are certain fundamental things about electric truck design, construction and operation that, let us hope, will soon be recognized by all. One of these is that standardization makes for quantity production and quantity production means a lower selling price. It is largely the special

design which keeps up the price. The buyer who is willing to concede the broader general knowledge of the manufacturer as regards the relation of design to operating efficiency is doing the industry a favor and saving himself money, either on the purchase price or on the operating end. Furthermore, every standard vehicle purchased brings quantity production, with its resultant advantages, nearer to us all.

### Standardization Helps Price

No, the special design is "impossible" from several standpoints. For his own protection, the live manufacturer will always add a larger motor for specially heavy requirements, but that can be done on a standard chassis. "No two vehicles alike," has done more to strew the motor truck industry with wrecks than anything else, unless it be inadequate capital. When it comes to bodies, trade practices may well be followed in general, but frills and alterations on the chassis are productive of expense, delay and dissatisfaction from the blacksmith's helper to the ultimate driver of the truck. Give us s-t-a-n-d-a-r-d-i-z-a-t-i-o-n and we'll give you the price.

### Large Transformers for Toronto Power Co.

The Toronto Power Company have recently installed six 6,000 kv.a., single-phase, transformers at their Niagara Falls step-up station and six 5,500 kv.a. similar single-phase units at their Toronto terminal station. This installation is of special interest in view of the fact that the new transformers were especially designed and constructed to fit the existing transformer pockets which were laid out originally for lower voltage units of less than half the present capacity. The original transformers were single-phase, water-cooled, units designed for 2,670 kv.a., 60,000 volts, at the generating station and for 2,400 kv.a., 55,000 volts at the terminal station. These transformers were of the familiar oval type. The new transformers are single-phase, water-cooled units of 6,000 kv.a. unit capacity at the Niagara Station, designed for 86,500 volts and similar units of 5,500 kv.a. each at the Toronto terminal station designed for 76,100 volts.

They were built by the Canadian General Electric Company at their Peterboro factory and are assembled in square or slightly rectangular boiler plate tanks, having all seams oxy-acetylene welded. The flat sides of the tanks are braced by "T" iron straps for mechanical stability. The transformer tanks were required to stand a 26-in. vacuum test at the factory before acceptance. The usual heavy castings have been replaced in this design by channel core plates rivetted together in pairs. A space is left between the channels which is arranged to come directly over a vertical duct in the iron, allowing a free circulation of oil up through the centre of the iron. These features and others which it is understood have been adopted as standard by the manufacturers of these transformers account for the remarkable increase in capacity per unit space over the original transformers in the same stations. The same factors are reflected in the gradual tendency toward smaller dimensions and lighter weights in power transformers making use of rolled steel instead of heavy castings.

### A Surplus in Every Case

The semi-annual report of the operation of towns and cities, included in the hydro-electric system, for the first six months of 1914 shows surpluses in every case. A number of reductions will result. The city of Galt, with an average monthly surplus of over \$1,000, gets a 16 per cent. reduction which brings the domestic rate to about 2½c. Other towns are eager for reductions and it is expected a number will be granted. Toronto's rates have not yet been finally determined.



# Practical Operation of Suspension Insulators

## Simplest Design of Insulator Advocated—Troubles with Short Circuits—Draw the Line Up Tight—The Use of Auxiliary Weights

By H. W. Buck\*

The application of suspension insulators to high-voltage transmission lines, since their first introduction in 1905, has been very general on all lines operating at voltages over 50,000, and the results obtained have been in most cases very satisfactory. The change, however, from the rigid pin insulator to a construction involving the free and flexible suspension of the conductor in space is a radical one and the change in practice has taken place with considerable abruptness, so that it is not surprising to have experienced a new class of line troubles. It is the purpose of this paper to point out a few of the difficulties which have been experienced, with the hope that a discussion of the subject may lead to improved standards of construction for such lines.

In the pin insulator line the conductor is held rigidly at every insulator, consequently lateral and longitudinal movement of the conductor is resisted at every point of support. Suspension insulators, however, except at dead-end connections, are free to move in all directions. The result is that high winds occasionally cause displacements which are electrically and mechanically dangerous to the operation of the line. Deflections of suspension insulators from the vertical position result also from other causes, which will be discussed later.

Large angular deflections of suspension insulators require large clearance spaces, which necessitate long cross-arms and increased cost of tower. Consequently it is desirable to limit the deflection as far as possible. A 60 deg. angle from the vertical is assumed to be the maximum allowable under extreme conditions.

In order to show how nearly the above limitation can be attained in practise Table I. is given, indicating the deflections caused by wind pressure on various sizes of conductor, at the insulator. The wind pressure assumed in the table is 15 lbs. per sq. ft. of projected conductor area, which is taken as the maximum. Wind pressure deflections are practically independent of span length, since wind pressure per span and the force which resists the wind pressure, namely, the weight of the conductor, both vary directly with length, in the same proportion.

Table I.

A	B	C	D
Size conductor	Wind pressure	Angular deflection	Auxiliary weight
<b>Stranded Copper</b>			
4	15 lb.	66 deg.	0.041 lb.
3	15 "	63 "	0.028 "
2	15 "	60 "	0.0 "
1	15 "	58 "	0.0 "
0	15 "	55 "	0.0 "
00	15 "	52 "	0.0 "
000	15 "	49 "	0.0 "
0000	15 "	45 "	0.0 "
<b>Stranded Aluminum</b>			
2	15 lb.	81 deg.	0.156 lb.
1	15 "	79 "	0.161 "
0	15 "	78 "	0.171 "
00	15 "	77 "	0.182 "
000	15 "	75 "	0.186 "
0000	15 "	74 "	0.196 "
250000	15 "	72 "	0.190 "

300000	15 "	71 "	0.177 "
400000	15 "	68 "	0.158 "
500000	15 "	66 "	0.125 "

Experiments have shown that the weight of the string of suspension insulators themselves will not act to resist wind displacement of conductor, since the exposed surface of the insulators is sufficient to cause their deflection by wind pressure without the attachment of the conductor. Neither will the deflection vary appreciably with the size and design of the insulators, since a heavier insulator ordinarily exposes a larger "sail area." The wind displacement of conductor can therefore be assumed to be independent of the number of insulators in the string, and of their particular design.

Table I. indicates approximately the wind deflections which will take place for various sizes of conductor under a stress of wind equal to 15 lbs. per sq. ft., as above. Two tabulations are given, one for copper, and the other for aluminum.

In Table I., column A shows the conductor size in B. & S. gage. Column B gives the assumed wind pressure in pounds per square foot of projected cable area. Column C gives the angular deflection of the insulator from the vertical, due to the assumed wind pressure on the conductor, assuming that the insulator itself deflects independently and neither increases nor decreases the displacement of the conductor. Column D shows the amount by which the weight of the conductor would have to be increased in order to reduce the deflection of the insulator under the assumed conditions to within the 60 deg. limit.

It will be seen from an inspection of the table that all sizes of copper except the smallest sizes listed, namely, No. 4 and No. 3, will ballast the insulators sufficiently to keep the wind deflection down to within 60 deg. A line of No. 4 B. and S. wire, it will be noted, is deficient in weight to the extent of 0.041 lbs. per ft. and No. 3, 0.028 lbs. per foot.

On the other hand, all the sizes of aluminum cable listed will allow deflections in excess of 60 deg., and especially among the smaller sizes, objectionable displacements will occur. Under these conditions one of the chief supposed advantages of aluminum, namely, its lightness, becomes its disadvantage, and the actual ballasting quality of copper due to its higher specific gravity and smaller size is a distinct advantage.

The larger sizes of conductor are more stable mechanically against wind deflection, since their weight in proportion to the surface exposed to wind is greater than in the small sizes, the weight increasing as the square of the diameter, whereas the wind pressure is only directly proportional to the diameter.

### Weighting the Line

Fig. 1 shows a method for reducing deflection which has been adopted on an aluminum transmission line in the South, about 200 miles in length, which has produced satisfactory results. The line is of No. 0 B. & S. aluminum cable, with an average span length of about 300 ft. An auxiliary weight made of cast iron is attached to the lower side of the suspension clamp at every insulator. It is consequently placed at a point where it is most effective as ballast. This arrangement results in very satisfactory stability of the line under all conditions.

Column D, Table I, shows the auxiliary weight which

\*Read before the A.I.E.E.



must be added at each insulator for the proper stability, expressed in pounds per foot of span. In the opinion of the writer, auxiliary weights of this kind should be provided on all aluminum lines using suspension insulators and on all lines where the smaller sizes of copper are installed. The auxiliary weight not only stabilizes the line against wind pressure but improves its operation in many ways, such as in resisting longitudinal movement of insulators under unbalanced pull due to a breakage somewhere along the line. It also improves conditions where a gust of wind strikes a single span independently, in reducing the slack which can be taken from adjacent spans due to unbalanced pressure.

A curious and unusual phenomenon has been experienced on at least one suspension insulator transmission line known to the writer. A severe sleet storm had occurred

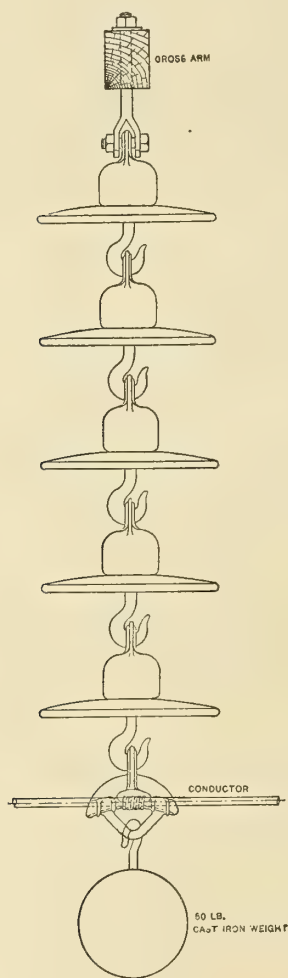


Fig. 1.

along the line during the night and all the conductors were covered with a heavy coating of sleet. When the sun came out in the morning the sleet started to melt, but it did not, naturally, fall off all spans of the conductors simultaneously. One span held the sleet longer than the rest in its neighborhood with the result that it sagged (taking the slack from adjacent spans) and came in contact with the conductor below, causing a short circuit. Such a combination of circumstances, although unusual, might happen on any suspension insulator line where the conductors are disposed in the vertical plane, and should be guarded against.

On long tangents on a suspension insulator line where there are no dead-end connections installed, if a very high wind strikes the line at an angle of about 45 deg. cumulative waves like the waves on the surface of the water have been observed to travel along the conductors of the line, causing

a whipping action at all suspension insulators, the waves finally "breaking" as on a beach at the first dead-end connection met. This phenomenon cannot occur on a pin insulator line, since the line is confined at every crossarm. This trouble can be prevented by dead-ending the line at frequent intervals.

The methods of dead-ending suspension insulator lines as at present practised cannot be considered satisfactory. There is a wide margin for improvement in the design of the mechanical fittings used for the purpose, especially in providing means for preventing the lateral swing of the jumper connection. Here, too, some form of ballast weight might be used to advantage.

In the experience of the writer the suspension insulator units which have given by far the best service over a long period of time are those of the simple general form shown in the assembly in Fig. 1. The design of these discs is entirely free from corrugations, flanges, petticoats, etc. While such devices increase the resistance of the insulator to surface leakage and surface arcing, the complexity of form seems to introduce internal shrinkage stresses in the process of moulding, firing and cooling, which in time, due to sudden temperature change or mechanical shock, will develop into puncturable faults. The insulator of simpler form is cheaper and more can be installed in series at the same cost and with the same electrical factor of safety as with a fewer number of discs of a more elaborate and expensive design.

#### Insulator Precautions

In general, most of the troubles which are being experienced in the various suspension insulator lines built to date can be overcome by the following precautions.

1. Provide liberal clearance between conductors and between conductors and supports. This should be considerably more than good practice would require in a pin type insulator line.
2. Install the lightning ground wire, if used, high above the conductors, so that no combination of gusts of wind can whip the conductor into it when suspension insulators are deflected to the maximum angle.
3. Place auxiliary ballast weights at every suspension insulator where aluminum cable is used and with the smaller sizes of copper.
4. Design the jumpers and fittings at the head-end connections so that the jumpers cannot possibly become displaced and come into contact with the crossarm.
5. Draw the conductor up tight throughout the line. A too conservative allowance of slack to guard against possible mechanical stresses in the conductor will cause more trouble than it will prevent.

The insulating properties of suspension insulators have proved adequate for all line voltages so far attempted up to 150,000 volts, and the satisfactory results have been attained within reasonable mechanical dimensions of insulators. The insulating units shown in Fig. 1, which are about as small as any made, electrically or mechanically, being merely 10-in. disks of plain surface, will arc over "dry" at about 80,000 volts and "wet" at about 50,000 volts. The arc-over voltage is well under the puncture voltage. Insulating units of more elaborate design will withstand considerably higher voltage tests. Mechanically, such insulators will withstand tension stresses of at least 5,000 lbs.

In determining the proper number of disks to be strung in series it is advisable to install the number required for the desired factor of safety and then to add at least one disk for reserve against breakage. In other words, the insulator should have a sufficient number of disks in series so that in case one or more are broken or punctured the remaining intact disks will afford a sufficient margin of insulation for



safe operation until such time as the broken disks can be replaced.

On this basis, assuming an insulation factor of safety of two, an 80,000-volt line would require four of the disks of Fig. 1, 100,000 volts, five disks, and so on for higher voltages. These results are interesting for comparison with the probable cost, mechanical dimensions and strength of a pin insulator which might give equivalent results.

### DISCUSSION

The following extracts from the discussion which followed have special practical bearing on the subject:

**H. W. Buck:** I want to corroborate what has been said in regard to the sag table. It is one of those engineering problems which are worked out in the office in accordance with certain theoretical laws which are apt to be more or less disregarded in the field. There are many such phases in engineering, and there are some good reasons for disregarding the exact science of such deductions in field work. A sag table is worked out usually for level country, with a few cases given as exceptions to apply to certain typical points on the line where the profile varies from level. With a line crew out in the mountains under severe stress of weather, working as best they may, possibly at low temperature and with high winds, it is absolutely impossible to get construction men to pay attention to such refinements as are usually given in sag table calculations.

The point of this is that we should not rely too much on theoretical data of this sort. We should give our instructions in such form and should make our designs with sufficient margin so that results can come within the scope of action of the average construction crew, and not make the operating success of a transmission line dependent upon the fulfilment of all the exact theory exemplified in a sag table.

**Charles E. Waddell:** A point brought out by Mr. Buck is the question of line ballasting and the effect of swinging of insulators. It seems to me that it is desirable to suspend the insulators so that they have infinite latitude to swing with the line, making a hinge for that purpose, but that the movements across the line be restricted to the lost motion in the joints themselves.

With a wind blowing across the line, the swinging is restricted to the individual span,—the line as a whole is not deflected outward. This prevents a wave starting that may ultimately end in the line rotating, with the result in some cases of wrapping the conductor around the ground wire.

I heartily agree with Mr. Buck as to the wisdom of using a number of small, single piece, inexpensive disk insulators. I believe these are to be preferred to the use of the two-part insulator with its greater surface and greater first cost.

I cannot say that I agree with Mr. Buck on the subject of ballasting the line, however. It seems to me it might be a very excellent desideratum where some emergency condition had to be met, but in designing new work I think that a lower voltage and larger wire, a more carefully graded line, and closer tower or pole spacing, would meet the same needs without introducing the added weight on structures and stresses on the insulators.

**R. J. McClelland:** Taking up the question of the arrangement of conductors, with regard to the "staggering" of conductors in vertical arrangement, it would be interesting to learn from the engineers who have used the extended middle arm construction if this has given the desired freedom from "sleet-jump" troubles. Has it been proved that 2 to 3 ft. horizontal offset in a span of over 1,000 feet gives satisfactory operating conditions at voltages of 60 kv. and over?

For protection against severe wind conditions only, the vertical arrangement of conductors is the better, whereas

the horizontal arrangement of conductors is better for protection against sleet troubles.

In some recent 110 kv. construction, an interesting expedient has been used to guard against excessive sag produced in one span due to unequal distribution of sleet over the adjacent spans. At every third or fourth suspension tower a special "semi-tension" insulator construction is used; that is, instead of one single string of insulators in suspension which allows the conductor to move in the direction of the line, as much as 14-in. in the case of extreme uneven sleet load, two strings have been used, attached to the tower at an angle of 45 deg. like an inverted V. Under normal conditions a tower with this construction is practically a suspension tower, and the conductor runs straight through without a sudden change in direction, such as occurs at a tower equipped with tension insulators and a jumper; but whenever unequal sleet loading takes place, the tendency of the heavily loaded span is to rob the adjacent spans of their sag and this is opposed by one of the "semi-tension" strings acting more as a tension insulator. I understand that sand-bag loading tests have indicated this construction to be effective and the application of this idea might prove of benefit for existing lines in the heavy sleet territories. This installation will be watched with interest.

It may be noted that I have used the term "tension insulator" in place of the usual "strain insulator" as the former designation would seem more closely descriptive of the actual working conditions of the insulator.

Concerning transmission line hardware for all heavy service I have found it desirable to eliminate all malleable cast iron hardware, and it would be well if structural or pressed steel fittings, or mild steel castings, were developed for this service, on account of the increased reliability that would be obtained thereby.

On certain double-circuit tower line construction our company has equipped both suspension and tension clamps of all insulator strings of one circuit with discharge horns, leaving the other circuit with discharge horns on tension clamps only. It will be interesting to compare the performance of these two circuits in service.

**V. Karapetoff:** I wish to take exception to statement No. 5 in Mr. Buck's paper, where he says "Draw the conductor up tight throughout the line. A too conservative allowance of slack to guard against possible mechanical stresses in the conductor will cause more trouble than it will prevent." I am afraid this statement, coming from such an authority as Mr. Buck is, will cause us more trouble than it will prevent. Several cases came to my attention not long ago where considerable trouble was caused by the conductor being drawn too tight, without reference to the stresses in the winter or during high winds. By interviewing the line superintendents, I found out that it is difficult to force the construction gangs and the foreman to conform to the tables of sags and also to use the dynamometer where the sag is determined by sighting the line. I wish very much that Mr. Buck would modify his statement so as to remove the impression that he does not believe at all in the correct calculation of sags and stresses, but simply advises us to draw up the lines as tight as possible.

**P. M. Lincoln:** I would like to make a statement in regard to the point just raised by Mr. Karapetoff. I am inclined to believe that Mr. Buck is quite correct in the way he puts it. I do not believe that any great difficulties are to be anticipated from drawing lines too tight. I think the tendency is in the other direction—to allow them to become too loose. If a line is put up too tight and cold weather comes along, it may possibly strain the material of the line above the elastic limit, but what is going to happen if it does? It simply stretches a little, and when the warm



weather comes along the stretch will result in a little more sag than before; but to stretch the material of the line above the elastic limit is not necessarily going to hurt the material. The material, in the course of its manufacture, has been strained above its elastic limit continuously, and if it is strained above the classic limit after it is in service it is not by any means fatal to the line.

**Julian C. Smith:** There is one point in Mr. Buck's paper to which I take exception, and that is the number of units which would be put on very important transmission lines. It seems to me that the number of units should be fixed by the climatic conditions or local conditions rather than the operating voltage.

**E. M. Hewlett:** Mr. Buck has explained that if an insulator is designed with a petticoat so short that the flash-over point is much lower than the puncture point, normally, under both dry and wet conditions, the insulator will be less severely strained and will not be subject to as rapid deterioration as has been shown by some of the insulators used now. A number of the recent insulators have too great a diameter of petticoat, so the flash over is too close to the puncture voltage.

Then, again, if you insulate your line for lightning conditions, as suggested by one of the last speakers, it will also be necessary to protect or insulate the transformers, lightning arresters, switches and everything else for the same conditions. This is a most important consideration.

Also, in the matter of mechanical strength, the distortion in design of the insulator to give great strength often works against the electrical characteristics. You thus han-

dicap yourself when you ask for strength greater than is required.

**H. W. Buck:** I am glad that Dr. Karapetoff has raised the question covered by paragraph 5 in the conclusions at the end of my paper, for it offers an opportunity to accentuate the point which I desired to cover in this paragraph. Most transmission lines are too slack and during the past year reports have come in from all parts of the country giving instances of short circuits resulting from conductors swinging together under wind stress, even where liberal clearances were allowed between conductors.

It has been customary to assume a heavy loading of sleet and the simultaneous action of wind velocities up to 100 miles per hour, allowing slack for these conditions, and then in addition to throw in a little for good luck. On top of all this slack, after the line has been in service for a few months the natural stretch which takes place in all conductor materials before a condition of permanent set has been accomplished, still further increases the sag of the spans. The result of this is that many transmission lines are a series of festoons between tower supports, with all the lack of inherent stability which such a condition gives rise to.

I cannot see any reason for modifying this statement in regard to drawing the wires up tight, unless by supplementing it with a statement that the towers must be made strong enough to withstand the strain. The first line of the paragraph in question should of course be read in connection with the following three lines, which qualify it, I believe, sufficiently.

# Municipalization of Hydro Electric Power

## In Sherbrooke, Quebec—An Exhaustive Paper Read Before the 14th Annual Convention of the Union of Canadian Municipalities

By B. A. Dugal\*

I have attended, in the past few years, several conventions of electricians, and have read in the papers and in the electrical magazines about everything that has been written on the municipalization of electricity, for and against. I never met, at conventions, electricians who were connected with private corporations, that were in favor of municipally owned plants. It is so very easy to find out why they are opposed to municipal plants, that I do not even need to mention it here.

A short time ago an American magazine gave a list of some thirty or forty municipal plants in the United States that were not a success, and went to the wall. I am not conversant with the local conditions where these plants were situated, and cannot account for their failure, but I will simply try, in answer to that, to give you the history of our Sherbrooke Municipal Plant and its success.

An electric municipal plant to be successful must generate its power by hydraulic power. Steam generated plants are very expensive, and it is figured up by engineers that it costs from \$20.00 to \$25.00 per year to generate one-horse power before you can get that horse power to do any work. A municipal plant must not have very long transmission lines to carry the current from the generating station to the customer. Transmission lines are both costly in initial cost and also in maintenance cost. Another point where municipal plants failed is where a large amount of power was developed and only about 40 or 50 per cent of said power was required by the local conditions and customers. In a case

like that the fixed charges are on the total of power developed while the revenue is only on the power sold, and unless a fairly good profit is realized, which means pretty high rates, both ends cannot be met.

I would like to mention here one drawback about municipal plants, which in our case, we have to suffer very often. When the Cities' and Towns' Act of the Province of Quebec was made and revised, there was no municipality in the Province which had municipalized public utilities, as an electric plant, and the different clauses of the Cities' and Towns' Act were not made, in a business-like way to govern any trade or commerce of that kind. After all, municipalizing and selling electricity is a commerce and industry like any other kind. We should be put on the same basis as all the other private corporations, in the same business. It takes us one or two months before we can make any important move. In our case, the electric department committee has first to study the question. It has then to be reported to the council at its first meeting. If it is a case of new expenditure, it will have to be referred to the finance committee. The finance committee will then report to the council. Again another resolution has to be passed by the council authorizing the officials to ask for tenders. The tenders will come in ten or fifteen days afterwards, and it takes another report from the committee to accept one, and before the department can give the order for the goods, one or two months have passed, and of course there are only twelve months in the year. If the expenditure asked for is to be paid out of borrowed money and has to be referred to a public vote, it

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means another month and a half delay. Representation should be made to the Quebec government that a special act should be made to govern and rule municipal plants. We have a Public Utility Commission and I do not know that they are so busy that they could not have time to look after us. Another drawback is the obligation we are under to buy everything by tender. In our business, almost every line of it is combined and the demand of tender for a certain line of goods with its ten or fifteen days grace, gives plenty of time to all trusts and combines of this country and of the United States to communicate with each other and all quote the same price, which means of course, in many cases a high price. I can prove that we can buy goods in many cases at much lower prices without tenders. Another drawback for a municipal plant is not to be able to sell electrically heated devices to promote in the sale of current. I do not know of a firm engaged in the sale of electricity which has not a new business department where all kinds of electrically heated devices are sold at a fair profit, but at the same time at a price which can be reached by the customer. Take our case here in Sherbrooke. We sell and claim to be giving to our customers about the lowest, if not the lowest rates for power, lighting or heating. I will give you these rates later on. Still the Cities' and Towns' Act forbids us to sell goods. We sold some at a profit from 20 to 30 per cent except in one case where we sold at 10 per cent. profit to promote our new rate for heating and cooking, which is only .02 cents per kw. hour. But the local merchants objected. They discovered, that in virtue of the Cities' and Towns' Act, we could not do it, and a protest was served on us and we had to stop selling.

At the last convention of electricians held in Montreal this summer, Mr. W. B. Johnston of Montreal, in a paper which he read says: "Prices should be maintained from 20 to 30 per cent above cost. Sale of appliances should not however be left entirely to dealers, as such sales are also boosted by the central station carrying them."

#### A Study of Retail Prices

Relying on that, let us study the retail prices of some of the electrically heated devices sold by dealers in Sherbrooke. A Munderloh, C. G. E., Northern Electric, National or Hotpoint sad iron which costs from \$2.75 to \$3.00 f.o.b. Sherbrooke, is sold at \$4.00 and \$5.00. A Hotpoint el glostovo stove costs \$3.00 f.o.b. Sherbrooke, it is sold at \$6.00. I could give you a complete list of apparatus and you will find the same thing. You can verify these figures by going into the store selling this apparatus. The same thing exists for electric lamps. The best wire drawn filament tungsten lamp can be bought to-day from 22 cents to 28 cents; we used to sell them at 40 cents but the dealers wanted to get 50 from the consumers. I cannot call that a reasonable profit.

Our population of Sherbrooke is composed of about 20 to 25 per cent who are getting in revenue or salary from \$1,000.00 a year or more, the balance is composed of laborers, workmen, mechanics or clerks who are earning from \$500.00 to \$1,000.00 a year. If some eight or ten dealers have to be protected in their business, I should say that there are 20,000 people, who are consumers of electricity, that are also entitled to be protected.

Municipalization of electricity was won in Sherbrooke, after several years of very hard fight, and after having been defeated twice by the people. The old Electric & Gas Company, would not be municipalized, and the city council, under the lead of Ex-Aldermen McManamy, Thompson, Olivier and others, bought the Westbury Basin Power which was called a "Gold Brick" at that time, and for which the city could get three times what it cost, to-day, to start a municipal electric plant.

Steps were also taken to buy from the local government, a part of the bed of the Magog River. The old company came to terms, and on the 1st of May, 1908, the city bought it out and paid the sum of \$250,000; an issue of bonds was made for \$170,000, and the old company's bonds, amounting to \$80,000, were assumed by the city. The purchase of the Magog River bed gave place to the famous suit between the British American Land Company and the city. It would be too long to give you the details of this, but in 1910 the whole question was settled "a l'amiable" and we bought all the pretended rights of the British American Land Company on the same part of the river. In 1911 as the demand for power was increasing very fast, we developed the "Drop Off Power" on that part of the Magog River. By doing this, we accomplished our dreams of being able to use the full flow of the Magog River twice, once at the "Drop Off" and again at our city plant right in the heart of the city.

Our plants are up-to-date and everything is kept up to the standard. The longest interruption of current for the past three years has not exceeded five minutes, and even then I do not believe it has taken place more than two or three times in three years. Of course on Sunday mornings, the current is turned off for repairs and cleaning up.

In 1908 the rates of power and lighting were as follows: Power from \$25.00 to \$45.00 per horse power; for lighting 10 cents per kw.hour. To-day the rate for power is  $\frac{3}{4}$  cent per kw. hour with a minimum bill of so much per h.p. per month on the total installation of motors. This minimum bill being from \$1.00 down to forty cents, according to the class the customer is in. The rate for lighting is 6 cents per kw. hour less 10 per cent discount. Window and sign lighting is sold under the flat rate of \$1.50 per 50 watts per year. Current for heating is sold at 2 cents per kw. hour, the customer can use that rate for anything he wants except lighting.

In 1908 we had 1,980 accounts; we have now 5,139. This is an increase of 259 per cent. The revenue of 1908 was \$72,214.62; this year it will be about \$135,000.00. The assets of the department in 1908 were \$351,365.96; on the first of July last they were \$740,874.14. The profit and loss account stood at \$98,652.26 in 1908; on the 31st December last it was \$203,406.92.

In 1908 we had for street lighting, a system of ninety-five old style arc lamps and a few dozen 32 c.p. carbon lamps. To-day we have over 1,400 high efficiency tungsten lamps, many of them being of the latest type, the nitrogen gas filled lamp, which affects a saving of current of 60 per cent on the wire drawn tungsten lamp.

In 1908 we had 1,036,000 ft. of distributing lines. We have to-day 1,527,280 ft. In 1908 we had three generating units with a capacity of about 2,000 h.p. We have to-day five units in two stations with a total generating capacity of 4,600 h.p. In 1908 we did not control a water storage. To-day we control one foot of water on the Memphremagog Lake which is 32 miles long, and from one to two miles wide, and five feet of water on the Magog Lake which is  $7\frac{1}{2}$  miles long and one mile wide. We have at the present time enough water stored in the two lakes to keep our two stations running full blast for sixty days if not a drop of water was to come to these lakes. This is our "White Coal." How much would it cost in coal to do the same work that this water can do?

The valuation roll of 1913 shows that there are in Sherbrooke 3,953 residences, tenements, offices, warehouses, shops, factories, etc. On the 1st of July we had 3,756 of them connected with our lines, leaving a little less than 200 not connected. Not many cities can show the same thing.



Our connected load in 1908 was about 3,000 h.p. It is to-day over 8,000 h.p.

Following I will give you some more figures in dollars and cents about our revenue and expenditure of 1913:

#### Electric Revenue 1913

Total from all sources ... .. \$101,989.11  
or \$22.66 for every h.p. we can generate (4,500 h.p.)

#### Electric Expenses 1913

Our fixed charges, including insurance, taxes, interest on bonds, amounted to \$34,324.02 or for every h.p. ... .. 7.62  
Our operating expenses were \$6,405.96 or for every h.p. ... .. 1.42  
Our maintenance expenses were \$23,494.59 or for every h.p. ... .. 5.22  
Our administration expenses were \$9,328.04 or for every h.p. ... .. 2.07  
Making a total production cost per h.p. of total generating capacity of ... .. 16.33  
This left a net profit per h.p. of ... .. 6.33  
4,500 h.p. at \$6.33 profit equal ... .. 28,485.00  
Our books and annual statement of 1913 show a surplus of ... .. 27,941.01  
Our recording instruments show that in 1913 we generate 5,100,000 kw. at a cost of \$42,405.54 not counting the interest and depreciation charges, or at an average cost per kw. of .. .00,831 ct.  
Our electric revenue for 1913 was \$101,989.11 or an average revenue per kw. of ... .. .01,999 ct.  
Leaving a net profit per kw. of ... .. .01,168 ct.  
5,100,000 kw. generated at .01,168 ct. profit per kw. would amount to ... .. \$59,568.00  
Our books and annual statement for 1913 show a profit of revenue over, operating maintenance, administration expenses of ... .. \$59,583.57  
These two statements show clearly that our municipal plant, although being worked along on low rates for power and lighting, is making good and is a success. It also shows that our profit is a real one and not one made on paper to attract stock subscription, or to boom shares on the market, as is very often done. To the most pessimistic ones, the ones that only dollars and cents will convince, I will say that on the first of July last our liquid assets were composed of:

Cash in hand ... ..	\$33,409.75
City of Sherbrooke bonds on hand bought from the city ... ..	75,000.00

Total ... .. \$108,409.75

This little paper was not intended to boast of ourselves. All the citizens of Sherbrooke are proud of owning so many public utilities, especially electricity. If any municipal plants were not successful, ours has been, and we hope that our success will induce many of the delegates at this convention to start a campaign in their own town, to municipalize public utilities, and have the ratepayers derive the benefit.

The beauty of municipalization of electricity is that there are no combines or trusts to make a ruinous competition, and all the profit instead of being paid in dividends to shareholders can be paid to the real shareholders who are our consumers, by giving low rates and good service.

### British Columbia Telephone Betterments

Innovations, extensions and improvements have been features of the policy of the British Columbia Telephone Company during the past few weeks. This company has its head office in Vancouver and is a provincial concern altogether, and the progress it is making is a creditable commendation to home management. Within the past week it

has announced a reduction in long distance telephone rates (affecting adjacent exchanges) of from 40 to 60 per cent; a special night rate for long distance, giving three times the length of a day conversation for the regular day rate between 7 p.m. and 8 a.m., and the institution of continuous service in all its exchanges, numbering thirty-nine throughout the province. No other company in the world gives continuous service over all its system. The larger cities need it, but in the small country exchanges, where the calls might not exceed one or two a night, the closing hour has been 10 o'clock.

The institution of these changes is in line with the policy of the B. C. Telephone Company to give the best service all the time. To do this it has completed an elaborate scheme of construction, supplemented with complete and the most up-to-date inside equipment. It has brought into inter-communication all its exchanges on the lower mainland and Vancouver Island, and also the interior exchanges. The company operates exchanges in the Slocan, Kootenay and Boundary districts, and owing to the nature of the country there a certain amount of isolation has existed. Acting in co-operation with the C. P. R. and Dominion governments, these interior exchanges are now within talking reach of each other, and it is only a matter of time before they will be in touch with the coast. The consummation of such a policy will make inter-provincial interests more mutual, will build up communities and result in British Columbia getting the full benefit of its own development.

To link up the various sections, connection with the Grand Forks exchange of the company was made with the provincial government line, which runs forty miles up the north fork of the Kettle river and is primarily intended for forestry purposes. Many settlers live along this valley. W. H. Beach had a line from Christina Lake to Cascade, and this has also been connected with the company's system, so that all the available telephone facilities are now within reach of all the people along these routes.

During the past few months the engineers of the company have been busy bettering transmission and making other improvements, the cost of which has been very considerable. Extensive relief work has been carried out or is in hand in Victoria to give service to new subscribers. Extensions have been made of the cable out of the Nelson exchange along the Hall Mines road. Reconstruction of the company's plant along the Chilliwack line of the B. C. Electric has been started. Because of the high tension wires in that locality underground cable is being put in at the crossings for the local lines, while all toll crossings are being standardized. The lead along Canoe Pass road, near Ladner, has been re-poled and is now in excellent condition. An extensive estimate is in hand for North Kamloops, where telephone service will be extended to Fruitlands.

The B. C. Telephone Company also expects to have two more exchanges in operation shortly, one at West Vancouver on the north shore of Burrard Inlet, and the other at Colquitz, just out of Victoria on Vancouver Island.

An instance of what betterment is being made is in the great reduction of trouble on subscribers' lines in Vancouver. In the past three years the increase of subscribers has been 109 per cent, while during the same period the decrease of trouble has been 71 per cent, a record that is difficult to surpass.

Another important private branch exchange is that signed up for the Hudson's Bay Company's new store. This will have an order board in connection, the first to be installed by a large commercial concern north of San Francisco.

The new telephone toll of copper, 24 wires in the initial construction, between Vancouver and New Westminster is about completed.



# Electric Railways

## Direct-Current Distribution for Surface Railways —Urban Service

By R. H. Rice

[A sub-committee on Distribution of Electric Energy was recently appointed by the American Institute of Electrical Engineers and a number of the more important problems in distribution have since been treated before the Association by members of the committee who have had particular experience in these problems. The following report on "Direct-Current Distribution for City Surface Railway Systems," by Mr. R. H. Rice, indicates the best and most economical practice to date].

Electric railways very frequently have energy furnished to them over high-tension, alternating-current transmission lines, and in this section of the report the sub-stations are included in the distribution system. The component parts of the distribution system for urban street railway service are then:

1. The converting equipment in the sub-station;
2. The positive system from the sub-station switchboard to the car, including feeders and trolley wires;
3. The negative system or returns, which complete the electric circuit from the car to the sub-station negative bus and include the electrical features of the track.

The usual city street railway system is characterized by having rather short feeding distances, large and rapidly fluctuating loads, and a wide variation in energy requirements at different hours of the day. Public demand is increasingly insistent upon quick and adequate service, better light and more heat, and this requires a greater amount of energy to be cared for in the distribution system, and greater reliability in its operation.

### Sub-Station Equipment

Sub-station equipment has become quite standardized and various installations differ chiefly in arrangement and in minor details. The equipment in a modern sub-station is housed in a well-lighted and ventilated building constructed for this purpose. It should be so arranged as to leave ample space for making repairs, and for installing or removing parts as may be necessary. A travelling crane is usually provided to facilitate such changes, but is now frequently omitted as the standard modern machinery is so reliable that it is rarely necessary to make replacements of parts requiring the use of a crane. Not only is there a saving in the investment for a crane but the building may be made lower and the side walls somewhat lighter, thus making an additional saving. Frequently no heating plant is installed as the waste heat energy from the machines is sufficient to give a comfortable working temperature.

The supply of energy to a sub-station is almost universally from three-phase high-tension lines, and for railways is of 25 cycles. For city service such high-tension lines should be, and usually are, underground to ensure more reliable service and to prevent danger to the public by exposure to high voltage. Conversion to direct-current in the sub-sta-

tions is by the universally accepted machine, the synchronous converter. It is desirable to have a separate high-tension line to serve each converter when the machines are of large capacity, and used in important city service. Switching arrangements are made to use any converter with any incoming line, so while the normal operation on the alternating-current side is by independent units of high-tension line, transformers, converters and other apparatus, emergency connections may be made as desired to interconnect the units. On the direct-current side the converters are operated in parallel, being connected to common positive and negative buses.

The synchronous converters used for railway purposes are 600 volt direct-current, compound-wound, and the later machines have commutating poles. Just a few years ago a 2,000 kw. unit was the limit in size, but 4,000 kw. machines are now in service. The cost of these large machines is less per kilowatt and they occupy but little more space in the sub-station, making the area per kilowatt much less than formerly. It is possible to place a 4,000 kw. machine on the same foundations formerly occupied by a 2,000 kw. unit. Care in design has made this improvement possible, and the later machines contain numerous refinements in design which in the aggregate improve this class of machine very materially.

Switching is performed by motor or solenoid-operated oil switches controlled from the main switchboard, and energized from a low-potential storage battery circuit. This battery circuit also provides current for the switchboard and station emergency lights.

An effort is made to keep the power factor of each station unit as near 100 per cent. as possible. The rotary shunt field and the reactance are so adjusted that with a given high-tension line voltage and direct-current voltage the converters will operate with 100 per cent. power factor when fully loaded. If the converters are operated under overload conditions there will then be a leading power factor, and if operated under less than full load there will be a lagging power factor. Most railway sub-stations can operate very near to 100 per cent., and this is usually desirable when energy is purchased from a central station company. In some cases a penalty is attached, in the way of increased power cost, when the power factor deviates from 100 per cent.

### The Positive Feeder System

There is not much variation in practise among companies in positive feeder distribution. In general the trolley line is sectionalized by line breakers or section insulators, placed as desired, and each section is fed from a separate feeder panel in the sub-station. This feeder is very often composed of several cables running by different routes and tapping in at different points to a distributing cable running along the street, from which feed taps are made to the trolley wire. The above "radial" system of distribution is not so economical of copper as a "network" system in which all of the trolley wires form a continuous network and the



feeders furnish energy to selected points of the network. As the load shifts from point to point all of the trolley wires and distributing cables act as equalizers and feed current to the point needed. It is difficult to locate trouble in an extensive network of this kind and also difficult to isolate the portion in which the trouble occurs, so that this method is not in common use. Some effort has been made to utilize the advantages of a network with the radial system by joining adjacent trolley sections through fuses or circuit breakers. Such a method has not been found satisfactory because it was impossible to adjust the connection so that it would distinguish between a heavy transfer of current from one section to another due to shift of load, which it should allow, and a heavy flow of current into a section due to short circuit, which it was not intended to permit. As a result these section connections usually became so unreliable that they could not be depended upon and were abandoned. A common practise at present is to provide knife switches, mounted in a pole box, which are normally open, but which may be closed on each end of a section if for any reason the feeders to this section become disabled. Such a plan provides a quickly operative and convenient device for ensuring continuity of service, as it is quite unlikely that the two sections adjacent to a disabled section would also be out of service.

#### Feeders Underground or Overhead

The feeders may be underground or overhead. In the largest cities, and in many of the smaller ones, the municipalities require underground distribution at least in the central business district. The underground cables are installed in tile ducts and at frequent intervals lateral connections are made between these cables and the trolley wire overhead. A typical lateral connection consists of a tile duct, or fibre-lined iron pipe, running from a manhole to an adjacent trolley pole, and connecting with a vertical fibre-lined pipe clamped to the pole. This vertical pipe should be at least 10 ft. high, and just above its upper end a switch box and lightning arrester are attached to the pole by means of brackets. The lateral underground cable is run from the manhole to and up the pole and connected to the switch. Between the top of the pipe and the switch the cable should be stripped of its lead sheath, taped and painted with an insulating paint, and the top of the pipe should be capped with a split wood plug which is cored to fit the size of the cable used in the lateral. This should be done to keep snow and rain out of the pipe.

The lightning arrester is attached to the riser from the switchbox and the ground wire passes down through the pipe to a ground rod in the floor of the manhole, or is attached to the rail. The mode of grounding the lightning arrester is a disputed point to some extent, but undoubtedly a good connection to moist earth is preferable to grounding to the rail. Running the ground wire through the lateral pipe may also cause some trouble, but this is frequently done, as no better method is usually available.

These laterals, although a relatively small part of the distribution system, may, if they are improperly insulated or installed, become the weak links which determine the strength of the whole distribution system. All cables should be rubber-insulated, the clamps holding the weatherproof riser to the pole should have an insulating band between them and the pole, and the cable should be held in the clamp by a split insulator. This gives three insulations between the conductor and the pole and will practically prevent "hot poles."

When the feeders are overhead the connection to the feed span is very simple, using either a jumper or making the span up with a tail. In this case lightning arresters are

spaced along the line as local conditions demand, probably about five to six to the mile on an average.

The most commonly used trolley line construction is the standard span supported on tubular two or three-section steel poles set at the curb line. The span wire almost universally used has been galvanized steel, but silicon bronze strand or copper-covered steel wire is now meeting with considerable favor. It has been found that steel strand frequently has very short life, especially in some manufacturing localities where atmospheric corrosion is especially pronounced, and other material resists such corrosion better than steel strand. The span should have two insulators cut into it between the trolley wire and the pole, and these with some form of insulating hanger for the trolley wire, give three insulations from wire to ground. Clinch ears are to be preferred to soldered ears and are more frequently used. The tendency is toward simplicity in construction, but with such means as will increase safety and reliability.

Overhead trolley special work is an important item in construction. There are many complicated layouts at busy corners, and reliability of construction is paramount. Often with long cars it is necessary to set poles considerably back of the curb line to secure proper clearance on curves, and sometimes the city authorities require that poles be set back to the building line at important corners. It is desirable to develop standard layouts which are designed with a minimum amount of overhead material, and in which the stresses are so balanced as to secure reasonable assurance of permanence in the structure. In such construction great care must be taken to align the trolley wire so that the trolley wheel can readily follow it without undue restraint.

#### Toughness and Tensile Strength

In the 1913 report of the Power Distribution Committee of the American Electric Railway Engineering Association may be found specifications for material and construction of overhead trolley lines. In the various annual reports of the Board of Supervising Engineers of Chicago will be found the results of numerous tests on trolley material, such as poles and strain insulators, and also descriptions of special forms of construction. One of the most difficult things to secure is a good quality of trolley wire. High conductivity has been assumed as the chief criterion in securing a first quality wire and other desirable qualities have been sacrificed to secure this one. For a city system, with dense traffic, many feeders and frequent taps, the conductivity of the trolley wire is not of paramount importance. The qualities of toughness and high tensile strength are most important and it is desirable to place an upper limit on the conductivity and make the other requirements more severe than has usually been the case. The particular qualities required and the method of securing them in trolley wire is a subject worthy of considerable study.

In any street railway system the load will fluctuate widely and it is a question of importance to determine upon what particular basis to design the feeder system. The load factor, that is, the ratio of the average load during the day to the maximum within the period, is usually from 40 to 50 per cent in an ordinary railway system. If the feeder system is designed to carry the peak loads without an overload on the cables, then during a large part of the day the current in the cables will be far below their safe carrying capacity and considerable copper will be idle. On the other hand, if the feeder system should be designed on a basis of say a six-hour average load, then the cables would be subjected to large overloads for a considerable period of time, heating would occur, the cables would more rapidly deteriorate, and a shorter life would result. The two-hour average is a good basis for feeder calculation as the ordinary percentage of load in excess of this value is well within the overload capac-



ity of the cable, especially since this excess load lasts for such a brief time. If this basis is assumed it means that the feeders will carry the entire load without being overloaded, except during two-hour morning and evening peaks.

The detailed method for computing the feeders necessary for a city system has been fully described by the writer in a paper published in the *Journal of the Western Society of Engineers* of June, 1910, and in the *Second Annual Report of the Board of Supervising Engineers, Chicago*. Briefly, the method is to determine from the proposed operating schedules the total number of cars required during the "rush hours," and plot them upon a skeleton map of the system, thus making a "spot map." The afternoon maximum period is usually the heaviest service period so that the car distribution for two hours of what is styled the "p. m. rush" is used on the map. On another map the trolley sections are indicated and the number of cars in each section determined from the spot map. This number of cars is then multiplied by the previously determined amperes per car, giving the current load for each section, which is placed at the centre of load of that section. The required number of amperes per car should be determined in all cases by tests upon the particular equipment used and service demanded. This map is the "load distribution map" and shows very clearly the energy requirements of the system.

#### Location of Sub-stations

A study should then be made of the proper location of sub-stations. The best probable locations and trolley sections for each station are selected and a graphical calculation of load centre for each station is made by finding the combined centre of gravity of the loads about each station. If the station locations chosen are not the most economical for distribution of copper, studies are made of comparative costs for other locations where the company may have property or where real estate may be obtained to advantage. After the station locations are definitely settled and shown upon this "station load centre diagram" and the sections to be fed from each station are decided upon, light radial lines are drawn on the "load distribution map" from each station to the centre of load of each section, which shows at a glance just what streets are fed from any given sub-station. Because of its appearance this modified "load distribution map" is known as the "spider diagram."

The most desirable routes for the cables are then determined, and the distance from the sub-station to the centre of load of each section is measured on a large scale-map. After the computation of the cable necessary for each trolley section has been made a "feeder diagram" is prepared. This shows, by a properly selected code, from which sub-station each trolley section is fed, the number, size and route of all cables, and whether the cable is underground or overhead.

#### The Size of Feeders

The calculation of the size of feeders to serve any given trolley section depends upon four elements:

1. The load in amperes upon the section.
2. The distance of the section from the station.
3. The allowable drop in the feeders.
4. The current-carrying capacity of the-cables.

It is desirable to limit the cables used to a few sizes only which may be kept in stock. The labor cost of replacing cables is practically independent of the size, and the larger sizes are thus more economical than the smaller. For underground cables the 1,000,000 circular mil size is a desirable maximum as it is readily installed in a standard 3 or 3½ in. duct, in lengths convenient for handling. The current-carrying capacity of a cable does not increase as rapidly as its cross-section, because of the inability of the cable to

radiate the heat developed. A great deal of study has been made upon the carrying capacity of cables but no very definite knowledge has been obtained, or at least made public, upon the safe capacity of cables of various sizes and kinds in ducts constructed in ordinary street soil. A carefully conducted series of tests, having this end in view, would be very desirable. In overhead lines the maximum size of cables is determined almost entirely by the weight of cable it is convenient to pull over the cross-arms and to handle upon the poles. Probably the most common size in city service is 500,000 circular mils.

The allowable drop in a feeder may be of any value desired and it is not usually fixed at the most economical value. For a city system subjected to large peak loads a small drop, even at peak loads, is desirable even though it is not economical with respect to feeder investment, because it is important to operate the car motors at approximately their rated voltage, and the public requires good illumination in the cars, which cannot be secured with a fluctuating voltage. A value of 10 per cent. positive line drop under peak load conditions is not too good a standard to set as this means a 60 volt drop on the common 600 volt system. Even this is too large a drop to allow unless the negative return circuit is also designed for a small drop.

The load on the trolley section and the route of the cables has been determined as previously explained. It is only necessary to measure the feeding distance on a large-scale map and then the elements of the computation are all known. The first step is to select the size of cable necessary to carry the load, and then compute the drop. In general for those sections near the sub-station the cable size fixed by current-carrying capacity is the proper size to use, but for the more distant sections the voltage drop limitation may require an increase in cable size. To make such calculations readily a chart may be used in which are curved lines of constant product, and super-imposed upon these are radial lines showing the relation between distance and drop for various sizes of cables. Numerous other means have been devised for making the same calculations, but unless there is a great deal of computation to be done at one time special methods are not needed.

When a number of stations furnish energy to a city system, each station has a feeding district of its own and may operate independently of every other. But it is usually advisable to operate such stations in parallel so as to distribute the load and to have the benefit of assistance from other stations adjacent if any one is partially or wholly disabled.

Theoretically, the best manner of accomplishing this is to provide direct equalizing ties between the positive buses of the stations just as machines are equalized in a station. The objection to this is the large cost of the cable which is necessary, and which is not utilized directly in furnishing current to the cars. Essentially the same result may be accomplished by feeding a number of the more important trolley sections from two separate sub-stations in such a way that in case of the shutdown of one station or of accident to one feeder, the cars on these sections could still be operated from the second station. These are designated as "tie-sections," and in addition to the above advantages, the feeders are so proportioned and calculated that on the whole system in case of the shut-down of one or two stations, the cars on the more important sections can be operated from the remaining stations by interconnecting through these tie sections. The amount of energy drawn over these tie lines is regulated both by the relative resistance of the cables and by voltage control in the stations. This tie line system represents in a measure the factor of safety necessary for successful operation. The number of such lines varies with the



importance of the stations and the density of traffic on the individual sections fed from them.

### The Return System

The design of any overhead trolley system naturally involves provision for as direct a return of current as possible to the negative station busbar. Practically all city railway systems use grounded return circuits, the negative side of the distribution system being connected to ground. Although utilizing the full carrying capacity of the track rails insures that the majority of the return current will follow this path, a certain proportion may reach other metallic underground structures which happen to offer another return path to the locality of the sub-stations. It is very desirable to limit these "stray currents" to a small value in order to reduce the possibility of electrolytic damage to a minimum. Another decided advantage in making the return circuit very good is of course to reduce the energy losses. It is too often the case that the return circuits, except possibly for rail bonding, are almost wholly neglected, while the positive system is carefully planned and constructed. A poorly built negative system does not jeopardize life or cause delays to the same extent as similar neglect in the positive system would do, but elements of danger and loss are present which should under no circumstances be neglected. Negative feeders are unlike positives in that the cables form a network all connected to the tracks, instead of a group of independent cables running to unconnected portions of the trolley wires. The earliest form of return circuit was the rails only, which were bonded at the joints, and later a connection was made at the power station between the rails and the negative bus. As the loads and distances increased the drop became excessive on these simple track circuits, and supplementary conductors were provided to reduce the drops. The simplest method of doing this is to provide return conductors in parallel with the rails, and in such sizes as to reduce the return drop to the required amount. As approach is made to the sub-station the current increases, due to the accumulated load, and in order to keep the return circuit from being overloaded the supplementary conductors must be increased more and more the nearer the approach to the power station. The amount of such supplementary copper necessary is computed from the allowable maximum return drop.

It is difficult to make a calculation for this supplementary copper in the case of a city system whose tracks form a complicated network of conductors. But it can be done by assuming the load distribution as in the positive feeder calculations and applying Kirchhoff's laws to each element of the network formed by the intersecting tracks. The track lengths, conductivity, and loading being known the drops may be found. If the drops must be reduced, this may be done by reinforcing the track circuits by additional copper.

### Connect Tracks to Return Frequently

In a grounded system, using the rails and supplementary copper for returns, in order to secure the full benefit of the supplementary copper it is necessary to connect the tracks frequently to this copper. This bond serves as an equalizer between tracks and enables the full track and cable conductivity to be utilized when the load is all on one track as well as when evenly distributed. The supplementary copper should be run through all special work and directly to the negative busbar. Where two cables cross, as at intersections, they should be electrically connected so that their equalizing effect may be realized. All rails on straight track should be at least well bonded, and preferably welded, so as to make the joint as good a conductor as the stock rail. At track special work, such as intersections, curves or cross-overs, it is not usually feasible to weld at the rail joints and

the special work may thus be cut off from good electrical connection with the tangent track. To preserve the conductivity of the track circuit, special work cables are run through the special work and welded to the tangent track at each end. The value of the return circuit thus does not depend upon the special work rails, which may be removed without materially affecting the conductivity.

The "insulated return system" is another method of constructing a railway return circuit. In this the return current is taken from the track circuit at various points, selected so as to maintain the track drop within any desired limits. The drop on the insulated cables may be of any amount up to the value which will cause the current to equal the carrying capacity of the cable, and the drop may or may not be of the same value on all the cables. The tendency will be for the shorter cables near the sub-station to become over-loaded and sometimes a resistance must be inserted in these cables to limit the current and make the drop approximately equal to that on the other cables. It is possible to use negative boosters with these insulated returns but they add much to the operating difficulties, and have found no favor in this country. The insulated return system has been used much more extensively in European countries than here.

## Rolling Stock for Montreal Tunnel and Terminal

Previous articles in the Electrical News have described the general design of the locomotives and motor cars for the 2,400 volt direct-current electrification which the C. N. R. are carrying out on their Montreal terminals. A more complete description of these equipments as given by Mr. W. C. Lancaster, electrical and mechanical engineer of McKenzie, Mann & Company, Limited, Montreal, in the current issue of the Electric Railway Journal, in part follows:—

### Locomotives

The 2400-volt d.c. locomotives are substantially the same in appearance and dimensions as those of the Butte, Anaconda & Pacific Railway. As the schedule for the locomotive trains does not call for high speed, it was not thought necessary to resort to any of the special methods of connecting the motors to the driving axles, such as are used on the side-rod and gearless types. The motors will be nose-supported in the usual way and geared to the axle by means of twin gears.

The locomotive has four axles with all the weight of the locomotive upon the eight driving wheels. The running gear consists of two four-wheel trucks, articulated together by a heavy hinge. The equalization of the trucks is accomplished by a semi-elliptic leaf spring over each journal box, connected through spring hangers to the frame and to the equalizer bars. The equivalent of a three-point suspension is thus obtained through the side equalization of one of the trucks and both side and cross equalization of the other truck.

The friction draft gear is mounted in the end frame casting of the truck. The cab, which is of the box type, is divided into three compartments, the centre compartment for the apparatus and the two end compartments for the operator. Each operator's compartment is supplied with controller, control switches, ammeter, air brake and pantograph control, air gages, 2400-volt cab heater, bell rope and control for the whistle and sanders, thus providing the locomotive with complete double-end control.

The motor equipment consists of four GE-229A commutating pole motors wound for 1200 volts and insulated for 2400 volts, two of these motors being permanently connected in series for operating on the 2400-volt trolley cir-



cuit. The one-hour rating of each motor is 315 h.p. at 1200 volts. The motors are designed for forced ventilation, which is obtained by means of a blower in the locomotive cab. Either pair of motors may be cut out, in case of emergency, by a special handle on the change-over switch. The locomotives are geared for a free running speed on tangent level track of approximately 45 m.p.h. and are operated as two-speed machines with ten points in series and nine points in series-parallel. The master controller used is of the non-automatic type and has two handles, one regulating the applied voltage at the motors and the other for controlling the direction of rotation of the motors. The rheostats which form the external motor resistance are placed near the roof of the cab and provided with ample natural ventilation.

The master controller and contactor energizing circuits are designed for 125 volts. Each contactor is easily accessible without any disturbance to adjacent contactors. A special electro-pneumatic change-over switch is used for making the transition between series and series-parallel connection of the pairs of motors.

The 125-volt current for operating the contactors and for lighting the cab and headlights is obtained from a motor-generator set, the motor of which has two 1200-volt windings and two 1200-volt commutators in series for operation on 2400 volts. This set is mounted in the centre cab and also drives the blower for providing forced ventilation to the main motors.

Fuses of the copper ribbon type placed in fuse boxes provide protection for each individual circuit as well as the main circuit from the trolley. These fuse boxes are all arranged to blow into a common chamber designed to take care of the arc. In addition to the fuse on the main circuit, a main switch is also provided. This is of the knife-blade type, being opened and closed by a handle placed in a position for easy operation in case of emergency or when it might be necessary to open the circuit while carrying current. This main switch blows into the chamber provided for the fuses, and has a powerful magnetic blowout.

#### Pantograph Type Trolleys

The trolleys are of the Butte roller pantograph type, pneumatically operated and mounted on insulated bases. Two pantographs are used per locomotive. A hand pump is provided in case a locomotive has been standing for some time and has no air supply.

A Warner speedometer, similar to the type largely used on automobiles but especially designed for locomotives, is located in each operating cab. These will be connected to the driving wheels of the locomotive by means of flexible shafts and gearing.

A combined straight and automatic air-brake equipment is provided on each locomotive. This equipment includes a 2400-volt motor-driven air compressor, the set consisting of two 1200-volt motors operating in series on 2400 volts and direct-connected to an air compressor having a displacement of 100 cu. ft. of free air per minute. The approximate total weight of each locomotive is 83 tons. Some of its principal dimensions and characteristics are given in the following table:

Length inside knuckles ... ..	37 ft. 4 in.
Length over cab ... ..	31 ft. 0 in.
Overall height, pantograph down ... ..	15 ft. 6 in.
Height over cab ... ..	12 ft. 10 in.
Over-all width ... ..	10 ft. 0 in.
Total wheelbase ... ..	26 ft. 0 in.
Rigid wheelbase ... ..	8 ft. 8 in.
Total weight, all on drivers ... ..	83 tons
Wheel diameter ... ..	46 in.
Tractive effort at 30 per cent tractive coefficient	49,800 lb.

Tractive effort at one-hour rating ... ..	20,300 lb.
Tractive effort at continuous rating ... ..	14,500 lb.

A floor plan of the cars shows that no sliding doors are used, as such doors tend to weaken the car just where most strength is required in case of collision. All the doors swing, so that the corners of the cars may be made as strong as is necessary. Cross seats are used near the centre of the car and longitudinal seats near the ends. This arrangement gives plenty of room near the doors where most of the crowding occurs when passengers are leaving or entering. It also tempts the passenger by means of the more comfortable cross seats to "move up to the centre of the car." The underframing is entirely of steel. The car body is also of steel except for window frames, wainscoting, side posts and part of the floor, which are of wood, and the headlining, which is of a heat-resisting, pressed-fibre board.

The underframing is of the centre box girder construction, employing two 9-in. 15-lb. channels spaced 16 $\frac{3}{4}$ -in. back to back and fitted with a top cover plate 26-in. x  $\frac{1}{4}$ -in. and a main bottom cover plate 24-in. x  $\frac{3}{8}$ -in. The body and end sills are of structural steel shapes. Trap doors of Edwards all-steel construction are installed. The bolsters are built up of plates and angles. The Standard Coupler Company's buffers and Miner draft gear are used.

The flooring consists of a bottom layer of tongue and grooved spruce, on top of which is spread a layer of three-ply "Salamander." Between this and the main floor is an intermediate insulating floor formed of  $\frac{1}{8}$ -in. steel plate, on top of which is also laid a layer of three-ply "Salamander." The main steel floor, on top of which is spread a layer of "Flexotile" composition flooring, consists of "Chanarch" steel.

As regards the side framing, the main side posts are formed of 3-in. x 2-in. x 5/16-in. rolled steel angles acting as a stiffener for the side sheeting and a suitable connection for the wooden side posts. At the belt rail the sheeting is further stiffened by a 4-in. x  $\frac{1}{2}$ -in. bar extending the full length of the body. The corner posts are built up of 3-in. x 2-in. angles with 3/16-in. pressed steel cover plate extending around and over the side and end sheets. The side sheets are of 0.110-in. thick cold rolled steel plate.

Particular attention has been given to the heat insulation. For the sides, roof and ends of the car this insulation consists of three-ply "Salamander." It is secured to the steel by means of glue and the Cleveland Tack Company's "Clinchite" nails spot-welded to the sheet steel and provided with steel retaining bands. This method is similar to that used by the New York, Westchester & Boston Railway.

#### The Trucks

The trucks are of this railroad's plate frame construction built for a centre plate capacity of 40,000 lb., and they are of the side equalized type. Case-hardening is applied for all hangers and rod jaws, for all pin ends of levers and where all holes occur in the same. The wheels are of rolled steel and are 36 in. in diameter. The journals are 5 $\frac{1}{2}$  in. x 10 in. and of the American Electric Railway Association standard with McCord boxes.

The outside and inside finish and all fittings and other details are made to conform as nearly as possible with Canadian Northern standard practice.

The principal dimensions are given in the following table:

Length over buffers ... ..	67 ft. 5 $\frac{3}{4}$ in.
Length over body corner posts ... ..	57 ft. 6 $\frac{1}{4}$ in.
Truck centres ... ..	42 ft. 9 in.
Width over side sill angles ... ..	9 ft. 10 $\frac{1}{2}$ in.
Width over eaves ... ..	10 ft. 2 $\frac{3}{4}$ in.
Height top of rail over roof ... ..	13 ft. 0 in.
Height top of rail to underside of side sill ..	3 ft. 7 $\frac{1}{2}$ in.



Centre to centre of body side bearings . . . 4 ft. 10 in.  
 Centre to centre deck sills . . . . . 5 ft. 6 in.

The approximate weight of the car loaded and equipped is 160,000 lb.

The electric hot air system of car heating is used. One complete heater is placed underneath each car and receives its energy direct from the 2400-volt supply. The heater has a capacity of approximately 25 kw. and is constructed for two heat combinations so as to provide for the changes in temperature conveniently and economically.

The complete heating equipment consists of the heating unit, blower and regulating mechanism, the controlling switch and thermostat of the regulating mechanism being arranged for operation from the 600-volt supply. Air is forced over the heating unit by means of the blower and distributed to the car through the air ducts along the sides of the car. The blower used for the circulation of the air is operated by a motor which is connected in series with the heating unit on the ground side. The capacity of the blower is approximately 1,000 cu. ft. of air per minute.

#### Motor Equipment

The motor equipment consists of four fully ventilated GE-239A, 125 h.p., 1200-volt commutating pole motors insulated for 2400 volts. Two of these motors are permanently connected in series for 2400-volt operation. Ventilation of the motor is accomplished by drawing air into the armature at the pinion end by means of the fan on the armature shaft. The air passes longitudinally through the whole interior of the motor and is expelled through an opening in the frame at the commutator end. This opening is protected by wire mesh. A back view of the brush-holder and support is also shown.

The control is of the non-automatic type for multiple-unit operation. The equipment includes a motor-generator set for furnishing 600-volt current for the control circuits, the air compressor and lighting circuits. This set consists of two 1200-volt motors, operating in series on 2400 volts, direct-connected to a 600-volt generator. The master controller, contactors, switches, reverser and pantograph are of essentially the same construction and appearance as those already described for the locomotives. The controller will have five steps in series and four steps in parallel. It differs from the locomotive controller in having the usual motorman's operating handle instead of a lever. This handle is provided with means for cutting off power and applying air brakes in case the motorman removes his hand.

Copper ribbon fuses similar to those on the locomotive will be used and an aluminum cell lightning arrester is installed on each car.

### Railway Electrification in England

The London & North Western Railway Company have under way the electrification of some eighty miles of single track, the first section of which was placed in operation on May 1st, of the present year. This consists of West London section from Willesden Jct., to Addison Road, and from Addison Road to Earl's Court; in all about seven and one-half miles of single track has been equipped to date. A brief description of the completed part of the system is described in the current issue of the *Tramway and Railway World*. High tension cables will, as far as possible be carried on short posts along the railway. The low tension cables will be laid underground. The conductor rails are all of a special low carbon soft steel having a weight of 105 lb. per yard; the electrical resistance is approximately six and one-half times that of copper. They are supported on porcelain insulators attached to the sleepers by malleable iron clips.

Trains, such as it is proposed to operate on these lines, will consist each of three cars having a total length of 179

feet. End doors are used with through communication, and both cross and longitudinal seats are provided. The electrical control gear will be supplied by the Siemens Companies. Every motor car will be fitted with four motors of 250 h.p. each.

The generating equipment will consist of five turbo-generators of 5,000 kw. each, three-phase, 11,000 volts, 25-cycles; transformers and rotary converters will be used to reduce the current to 600 volts d.c. Storage batteries will also be installed for peak and emergency service.

The transformers are being manufactured by the British Electric Transformer Company; sub-station plants by the British Thompson-Houston Company; the electrical apparatus of the trains by the Maschinenfabrik Oerlikon.

### Personal

**Mr. W. D. Gilroy** formerly of Nelson has been appointed manager of the Kootenay telephone lines.

**Mr. G. W. Robb** has resigned the position of superintendent of motive power of the Grand Trunk Pacific Railway, and is succeeded by Mr. Joseph Billingham. Mr. Billingham was at one time connected with the London & North Western Railway, England. He will make his headquarters at Transcona, Man.

**Mr. G. Gordon Gale** for many years general superintendent of the Hull Electric Company has recently been appointed general manager of the company. Mr. Gale is a graduate of McGill University and has had valuable experience both in operation and management. Prior to 1907 he was assistant engineer of the electric plant of the Canadian



Mr. G. Gordon Gale.

Rubber Company. In that year he became associated with the Hull Electric Company and has filled successfully the positions of superintendent of power, acting superintendent, and, for the last five years, general superintendent. Mr. Gale's company, in addition to operating a railway system, furnish light and power in Hull, Aylmer and intervening points.

The Philadelphia Rapid Transit Company have closed a contract with the Duff Manufacturing Company, of Pittsburgh, to have every car on their system equipped with the "Barrett" emergency car jack.

The Canadian Vickers, Limited, Montreal, recently purchased a 600 ampere arc welding set from Mr. J. D. La-chapelle, Canadian sales manager of the C. & C. Electric & Manufacturing Company.



# Illumination

## "White Way" in Edmonton

The accompanying photograph represents the new "White Way" lighting on Jasper Avenue, Edmonton, Alta. This street was formerly lighted by magnetite arc lamps perched on the top of the trolley poles in the centre of the street and fed from mercury rectifiers by an overhead line. Early in 1914 work was commenced on the installation of a row of ornamental standards on each side of the street. These also carry magnetite lamps furnished by the C. G. E. Company. The feed wires for the new system are



The Great White Way, Jasper Ave., Edmonton.

underground, a trench being dug in the sidewalk about 12 inches from the curb. A 2½ in. fibre duct is installed in the trench and filled in with concrete.

In the outlying districts where permanent sidewalks are not yet placed, a concrete pier was built to support each standard and the armoured cable placed in a trench about two feet deep. Some 90 new lamps, representing about half what the city plans to put in service in the near future, were turned on on July 14. The illumination resulting from the new installation is very effective. The work was carried out under the supervision of Mr. A. W. Ormsby, superintendent of the light and power department, and Mr. Ingalls in charge of the arc lamp department.

## Electrical Street Decorations in Seaforth

As a decorative and attractive feature the profuse use of electric light is becoming one of the most important factors in "home coming" demonstrations and similar festivities, as practiced in our Canadian towns and cities during the recent past. This was demonstrated in a remarkable way at last month's "Back to Seaforth" gathering, where a thrifty population of something less than 2,000 souls transformed itself into a city of considerable dimensions chiefly by mak-

ing itself look big on the map through an almost prodigal use of tungstens. It is said that no less than 10,000 lamps were used in this demonstration, and a view of the main street as shown herewith lends credence to this report.

Features of the demonstration included a large electric "Welcome" sign at the depot; a Court of Honor located about half way along the main street, donated by the Knights of Pythias Society; elaborate decorations on the town hall; and suitable and characteristic signs by the various fraternal societies, such as the C. O. F.; A. O. F.; L. O. L.; I. O. O. F.; and A. F. & A. M. The K. O. P. had individual illuminated decorations characteristic of their respective societies. Numerous merchants also installed displays of their own using all the way from 50 to 500 lights each. The wonderful lighting effects are credited largely with the success of this reunion which both in numbers and financially is something which Seaforth will long remember with pleasure. Electric current for the demonstration was donated by the Hydro-electric Power Commission, the entire installation being illuminated from dusk till about 2 a.m.

The entire decorative work was in charge of the Electric Decorative & Equipment Company, 70 Lombard Street, Toronto, who have been making for themselves a very enviable reputation by this and similar installations at various points



"Back to Seaforth" street decorations.

in the province. This company specialize on decorative lighting and prepare regular plans and sketches for the entire scheme and co-operate with local authorities and with individuals so as to obtain the best possible general effects. The wisdom of such an arrangement is at once evident. A number of individual attempts at decoration are very apt to run into a lot of money without producing much in the way of general effect. As in everything else the combination of forces under skilled supervision gives best results.



# *The Dealer and Contractor*

## Model Plans and Specifications

**For an average size residence—Of special interest and value to Electrical Contractors and Architects**

We print herewith a typical set of plans and specifications for the wiring of a residence of average size. The dimensions of the house, verandas excluded, are 38 x 26 outside measurement.

It is not expected that these plans will coincide with the individual tastes or requirements of every house builder. We believe, however, that they represent a fairly ideal installation taking into consideration the comfort and requirements of the average citizen. In this connection we mention below a number of features which, without adding anything appreciable to the cost of the installation, materially assist in perfecting the refinements of control and make for convenience and economy of operation.

(1) Absence of brackets—It will be seen that there are practically no wall outlets, these being confined to the one in the pantry, one in the attic hall and one in each of a number of closets. Even in these isolated cases a little added expenditure would have been justifiable and have made the installation, in our estimation, still more perfect. The idea is, however, that all brackets shall be controlled by pull chains, these being especially satisfactory for the closet lamp which is intended to be installed immediately above the door way with the chain hanging three or four inches below the frame; this can be picked up easily in the dark by running the hand along the top of the frame. The objection to brackets is daily becoming more universal. They are generally in the way of furniture or decorations; they collect dust and dirt; they engender untidiness as they are often used as hooks, and at best they only localize the light. All the advantages of the wall lamp, without the disadvantages, are found in the baseboard receptacle of which these plans show a liberal number.

(2) Arrangement of circuits—The baseboard receptacles in this plan are kept on separate circuits by themselves. This arrangement gives two circuits in every room so that in the event of an interruption on one circuit the room will not be left entirely without service and a fuse being blown by a fault developing in a worn flexible cord will not interrupt the lighting of any regular ceiling outlet. This gives a somewhat larger number of circuits than is absolutely necessary and takes a few feet more wire, but it has the advantage of allowing a liberal capacity on every circuit so that if an unexpectedly large load is taken from any outlet that circuit is not likely to be dangerously overloaded.

(3) Special closet outlets—As already noted a small wall lamp is provided above the door in each closet. The additional expense for these outlets is very small, the current consumption will be negligible and the added convenience, especially in closets the shape of those shown, is very material indeed. Especially where clothing or supplies is placed on shelves a good lighting is necessary to maintain a pro-

per tidiness. Such a light in the medicine closet will tend to prevent the use of carbolic acid for castor oil.

(4) Switch controls—The arrangement of switches in the main halls would appear to be especially convenient without over-elaboration. It will be noted that the lamp in the lower hall is controlled by three switches consisting of the usual two three-ways, one upstairs and one down, and an extra three-way downstairs placed in series with the other two and which acts as a selective switch. This makes possible the use of either a small light or a brilliant light as desired, a small lamp being considered sufficient in most halls the greater part of the time. Three-way switches are not installed to control the attic hall light though this is a convenience many householders would add.

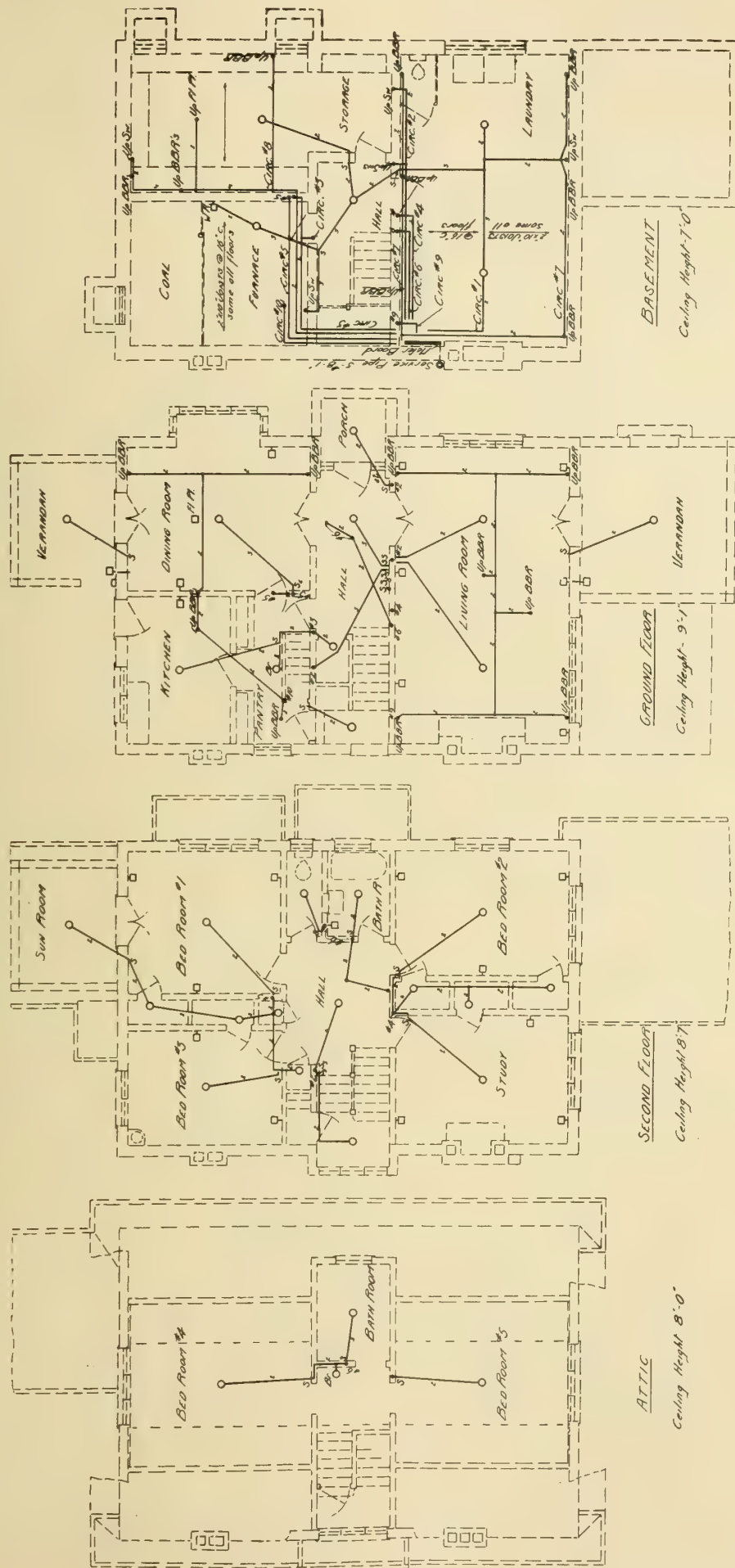
The dining room light is controlled by a two point electrolier switch which admits of low light being used for setting and clearing the table. The rear entrance light is operated from the same switch as the basement hall, it being considered that the former will rarely be needed except when going down cellar and also that it will serve as a pilot to show when the basement light has been left burning. The intermediate landing light is also controlled with the upper hall since this will be a small wattage lamp and is generally needed when the upper hall is needed. Electrolier switches for the living room, though not installed in this plan, would probably be considered essential in the average case as they would make possible better general control of the illumination as, for example, when a number of localized lamps are being lighted from the baseboard receptacles and the full ceiling illumination is not required.

(5) The service is made heavy enough to stand the addition of an electric range. Though in this particular case the wires have not been installed this is only because their installation at a later date will be an exceedingly simple matter.

(6) Ironing outlets—In the back verandah and in the kitchen where ironing is most likely to be done, outlets have been placed high (6 ft. from floor) so that the ironing cord will not interfere with the work. These outlets are equally valuable for any other apparatus. We believe this is an important feature for the hanging cord so often installed in the ceiling is unsightly and does not admit of an absolute uniformity of base receptacle and plug throughout the building—a very important consideration. Individual requirements may demand a similar outlet in the laundry.

(7) Baseboard receptacles—A liberal number of baseboard receptacles are installed at convenient places. These will carry lamps, toasters, water-heaters and, above all, small electric heaters for spring and autumn use before the furnace is operating. A receptacle has been placed on the front verandah as this, if windowed, is most likely to be the place where an afternoon tea or a lazy breakfast will be served. The floor plug in the dining room is also calculated to supply a sufficient number of electric utensils to cook a small meal. The plan suggested is to connect a plug in the floor with two or more flush plugs at convenient





Model wiring diagram, for illumination purposes, of a typical residence of average dimensions—Also see specifications.



points in the table. The unsightly appearance of a number of cables hanging from your electrolier is thus avoided. The floor contact also is a permanent one and need only be removed in case the table is to be moved a considerable distance. The two additional baseboard outlets at the sideboard and buffet will admit either of decorative lighting or frying operations which might spoil the table linen.

(8) It will be noted that no provision is made in the hall for the operation of an electric sweeper. It may be contended that the liberal distribution of baseboard outlets in the various rooms would serve this purpose, but we believe it would be better to have a separate power outlet for each hall so that the stairways especially may be reached. This is particularly true of the upper flat where baseboard outlets in the different rooms have not been specified. A hall outlet will, in this case, serve to operate a vacuum cleaner at any point on this flat. It may be contended that in the strictly modern house a stationary vacuum cleaner should be installed, but we believe it is open to question whether a house of the size represented here would be justified in including what may yet be considered as something of a luxury. Much will depend, of course, on the method of furnishing to be adopted. With the modern fairly general unpopularity of carpets and their replacement by small rugs the necessity of the large vacuum cleaner is not so apparent.

(9) No mention is made in the specifications of wiring for bells or annunciators, but this is a matter about which individual tastes differ very widely. In the particular house under discussion we have been given to understand that the front door is connected with one bell and the back door with another; also that the dining room and living room are connected to a (the same) buzzer. In a house of this size upstairs bells hardly seem to be necessary though some householders prefer one push button at least upstairs, which might, in this case, be connected with the front door bell. In the dining room connection is made with a push button in the table through a floor outlet, and a push button in the living room is so located that it is easily accessible from the front veranda. Again it is a matter of individual taste whether these bells should be operated off batteries or a transformer. The strictly modern installation would use the transformer, but where small economies are a consideration it is possible the batteries will be favored.

### SPECIFICATIONS

These specifications are intended to cover the supply of all necessary material and labor for the installation of a complete wiring system for lighting, etc., in the new residence for ... .. Toronto.

### Working Conditions

1. House is built and roofed but not finished. Electrical work may be started immediately.
2. House is of standard brick construction.

### Plans

Plan No. C-38 shows the "Wiring Plan of Residence," and shall be considered as forming an integral part of these specifications.

Circuits are indicated by single heavy lines, the number of wires in each run being marked by small numbers.

In all cases, circuits are located between the ceiling of the floor, on which they are shown, and the floor above.

### Detail Specifications

1. Install standard service pipe in rear of house, as shown, same to consist of three No. 8 wires in 1-in. conduit.
2. Install meter board 3 ft. wide by 2 ft. high covered with a clear sheet of ¼-in. asbestos, painted black.
3. On meter board install one 3 p.s.t., 250 volt, 60 amp. knife switch and five 3 to 2 wire double branch fuse blocks

with fuses and make all necessary connections ready for meter.

4. Install 10 branch circuits throughout the house as shown on the plan and detailed in the following summary:

### Circuit Summary

Circ. No.	Location	Ceiling Out-lets	Bracket Out-lets	Base Board Outlets	Switches	Watts	Side Service
1. Basement							
	Laundry .. ..	2	..	..	1	..	R
	Verandah .. .	1	..	..	1		
	Hall .. .	1	..	..			
	Rear Entrance.	1	..	..	1	440	
	Storage .. .	1	..	..	1		
	Furnace .. .	1	1 W.R.	..	1		
2. Ground Floor							
	Living Room.	2	..	..	2		L
	Porch .. .	1	..	..	1		
	Lower Hall. .	1	..	..	{ 2 (3w) 460 1 (E1)		
	Upper Hall ..	1	..	..	2(3w)		
	Landing .. .	1	..	..			
3. Ground Floor							
	Dining Room.	1	..	..	1 (E1)		R
	Coat Room ..	..	1	..	..		
	Kitchen .. .	1	..	..	1	400	
	Pantry .. .	..	1	..	..		
4. Second Floor							
	Study .. .	1	..	..	1		L
	Bedroom No. 2	1	..	..	1	440	
	Closets .. .	..	3	..	..		
5. Second Floor							
	Bedroom No. 1	1	..	..	1		R
	Bedroom No. 3	1	..	..	1	460	
	Closets .. .	..	4	..	..		
	Sun Room ..	1	..	..	1		
6. 2nd and 3rd. Flrs.							L
	Bath Room ..	1	..	1	1		
	Toilet .. .	1	..	..	1		
	Bath Room ..	1	..	..	1	360	
	Upper Hall ..	..	1	..	..		
	Bedroom No. 4	1	..	..	1		
	Bedroom No. 5	1	..	..	1		
7. Ground Floor							R
	Living Room..	1	..	6	..	420	
	Verandah .. .	..	..	1	..		
8. Ground Floor							L
	Kitchen .. .	..	..	1	..		
	Dining Room. .	..	..	2	..		
	Verandah .. .	1	..	1	1	360	
9. Second Floor							L
	Study .. .	..	..	3	..		
	Bedroom No. 2 ..	..	..	3	..	360	
10. Second Floor							R
	Bedroom No. 3 ..	..	..	2	..	300	
	Bedroom No. 1 ..	..	..	3	..		
	Totals .. .	26	11 <sup>1</sup>	24 <sup>2</sup>	26 <sup>3</sup>	4,000 <sup>4</sup>	
	<sup>1</sup> 2 standard, 8 closet, 1 wall receptacle.						
	<sup>2</sup> 23 standard, 1 floor plug.						
	<sup>3</sup> 20 standard, 4 3-way, 2 electrolier.						
	<sup>4</sup> 2020 R, 1980 L.						

### Nature of Work

1. All work shall be standard "knob and tube" construction, in all respects of the most up-to-date practice and best workmanship.
2. All wires brought down walls of basement to switches, etc., must be run in metal moulding.



### Location of Outlets

1. Ceiling outlets must be accurately located so as to bear a proper relation to decorative detail.
2. Bracket outlets in all closets to be located immediately above the centre of the doorways. (It is intended to equip these with pull receptacles).
3. Other bracket outlets in pantry and top landing to be located 5 ft. 6 in. above floor.
4. Baseboard receptacles to be mounted 6 in. above floor, except kitchen and back verandah, which are 6 ft. above floor.
5. Switch outlet to be mounted 4 ft. above floor unless special wall details require otherwise.
6. In any case where the direction of door swing is reversed from that shown on the plan, the switch must be changed to the opposite side correspondingly.
7. Switch outlets located on any panelled wall must be carefully centered.

### Control

1. All switches indicated on the plan will be of a standard single pole type controlling one outlet only, with the following exceptions:
  - (1) Both laundry outlets to be controlled together by the same switch.
  - (2) Rear entrance and basement hall to be controlled together by the same switch at pantry door.
  - (3) Main hall to be controlled by a pair of 3-way switches in lower and upper halls and also with a single button, 3-way switch serving as an electrolier switch.
  - (4) Upper hall and intermediate landing to be connected in parallel and controlled together by a pair of 3-way switches in lower and upper halls.
  - (5) Dining room to have a 2-circuit electrolier switch.

### Fittings

1. Switches.
  - (1) Basement switches to be rotary snap switches of approved type.
  - (2) All other switches to be push button switches of best quality Perkins or equivalent.
  - (3) Electrolier switch for hall to be a single button 3-way push switch, Perkins Type 0 No. 2458 or equivalent.
  - (4) Electrolier switch for dining room to be single button, 2 circuit push switch, Perkins Type 0 No. 2460 or equivalent.
2. Switch Plates.
  - (1) All switch plates to be nickle finish unless otherwise required to agree with room hardware.
  - (2) Upper hall plate to be standard 2 gang plate.
  - (3) Lower hall plate to be a single plate providing for 4 two-button switches and one single button switch, Perkins No. 3655 or equivalent.
3. Baseboard Receptacles.
  - (1) All baseboard receptacles to be uniform and of best quality Diamond H or equivalent.
  - (2) No plugs to be supplied.
  - (3) Finish of face plates to agree with other hardware of room.

1. The "General Conditions" attached herewith shall be considered as forming an integral part of these specifications.

2. All materials and workmanship shall conform to the requirements of the Canadian Fire Underwriters' Association and their certificate furnished at the completion of the work.

### General Conditions

1. These General Conditions shall be considered as forming an integral part of any specification to which they may be attached and shall be absolutely binding in carrying out

any contract awarded in accordance with such specifications.

2. The following interpretations shall be taken of terms used throughout the specifications:

**The Proprietor** means the party or parties who own the building or properties in which the contract is to be fulfilled. In this case ... ..

**The Contractor** means the party or parties to whom any contract may be let on the basis of these specifications.

**The Architect** means the architect or firm of architects under whose charge the building work is being carried on and who is exercising supervision over any or all trades which may be doing their work at the same time as the work called for under these specifications. In this case ... ..

**The Engineers** mean the engineers who have drawn up these specifications and under whose supervision any contract awarded on the basis of such specifications must be carried out, namely Messrs. Ewart & Jacob.

3. The contractor (unless otherwise specified) shall provide all materials, workmanship, plant, scaffolding, carriages, freightage and every other matter that may be required for the proper performance and completion of the work and the whole of which are to be the best of their several kinds.

4. The plans accompanying these specifications shall be considered an integral part of the same. Specifications and accompanying plans are intended to co-operate, so that any work shown on the plans and not mentioned in these specifications, or vice versa, is to be executed the same as if set forth by the plans and mentioned in these specifications.

5. Should any drawings or figures be omitted in the plans and details, which are necessary to a clear, comprehensive understanding, or should any error appear in either plans or specifications, it shall be the duty of the contractor to notify the engineers in writing of such omission or error before submitting tender and in no case proceed in uncertainty with the work.

6. If in the opinion of the contractor a change of plans or specifications should be made for the proper completion of the work and if such change alters in any way the original amount of the tender, the contractor must notify the engineers and submit price in writing for approval before starting the work, otherwise the engineers will not recognize any change in plans or specifications and no claim for extra payment will be allowed.

7. The plans accompanying these specifications are made as accurate as possible, but absolute accuracy of dimensions cannot be guaranteed. No claim for extra payment on account of difference of actual and estimated dimensions shall be allowed, unless such difference arises through alteration of building plans by the architect, or unless such difference shall be greater in amount than ten per centum in each case. On all plans figured dimensions are to be taken in preference to measurement by scale and drawings on a large scale are to be taken in preference to those on a small scale.

8. On all plans, the correct size, location and nature of all walls, partitions or obstructions of any kind are indicated as accurately as possible. If any additional obstacles are encountered the contractor must make good all work through or around such obstacles the same as if they had been originally indicated and no extra claim shall be allowed on account of such obstacles.

9. The contractor shall at his own cost make good any defects, settlements, shrinkages, burn-outs, grounds or other faults in his work, arising from defective or improper materials, which may appear within twelve months after the completion of the contract.

10. The engineers reserve the right to reject any and all materials which, in their opinion, are unsuitable for the proper completion of the work, or not in accordance with these specifications or accompanying plans. Such rejected mater-



ials must be removed from the premises forthwith, and if used after such rejection the contractor shall, at his own cost, tear down such materials and replace same with approved materials.

11. Successful contractor shall be required to sign the specifications and accompanying plans as well as revised contract form in which shall be stated manner of payment, time limit, amount of tender, etc.

12. The proprietor reserves the right to accept or reject any or all bids presented in determining to whom said contract will be awarded. The tenderer's reputation, as well as the amount of his proposal, will be considered and the contract made in accordance therewith.

13. The contractor will notify the engineers in writing when his contract is completed. This dated letter will be necessary to obtain his final certificate, which will be issued within thirty days after notification, if the engineers, on inspecting the work, consider the same complete.

### Overhead Charges—The Cost of Doing Business

This is the way the Joint Conference Committee of the National Association of Master Steam and Hot Water Fitters and the National Association of Master Plumbers puts the case:

The ordinary estimate, while made up of a great many items, may, for the purpose of this discussion, be summarized under four principal headings as follows:

1. Cost of Materials.
2. Cost of Labor.
3. Cost of Doing Business. ("Overhead Charges").
4. Profit.

As to the cost of materials, there is no good reason why every bidder who exercises due care in taking off his quantities, and who really knows how to take off those quantities, should not have approximately the same amount to cover this item.

Cost of labor is in every sense an estimated item—no one can state definitely just how many days will be required to do a certain piece of work. We all have ideas as to the time required, and these ideas are in most cases backed by experience, but after all it is largely a matter of judgment—with many of us it seems to be a matter of positive guess-work.

There are no rules laid down which govern this all important item, but if its cost is made up honestly by one who is fitted to do it, if due consideration is given to the required time for each particular part of the work, if the time is based not upon what the quickest and cleverest journeyman is able to accomplish but upon what the journeyman of average ability can do; if due allowance is made for lost time and for smoothing out the many perplexities which always arise on any job, then we shall be more nearly together in our estimate of the number of days required.

With the cost of labor as high as at present, we cannot afford to estimate an insufficient amount to cover it, for if our actual time exceeds very many days our estimated time, our entire profit in many instances is eaten up.

In many offices, on all important work, no less than three (many times as many as five) competent men estimate on the item of labor, each absolutely independent of the other. If the time estimated by these men runs fairly close, then the average is usually accepted; but if there is a wide difference, then the three or more get together and go over the work item for item, and discuss it pro and con, and finally decide what amount is to be used.

You may say that you have no one but yourself to depend upon for this work. If that is so, call up your foreman; and if you have no foreman, talk it over with one of

your journeymen in whose judgment you may have confidence.

Finally: If you must guess—guess big and then double it.

Now we come to the cost of doing business, or more briefly called overhead charges. The item is perhaps less generally understood than any other in the entire estimate.

Many of us are what are known as "practical" men. We may not have enjoyed much of a business training, but have acquired what knowledge we have in the hard school of experience—with the tools and on the job. Others of us lack this practical knowledge, but have secured our training through the office end of the business—the school of system and of cost and profit.

Each of us has much to learn from the other, but what we all should know is what "overhead charges" really means.

In the conduct of a business, however small, there are certain items of expense for which we have to provide, whether our sales are large or small—they are unavoidable and cannot possibly be side-stepped.

1. The rent has to be paid.
2. The bill for heat and light has to be paid.
3. The salaries of bookkeeper, stenographer and salesmen have to be paid.
4. Liability insurance on workmen has to be paid.
5. Fire insurance on shop, tools and merchandise has to be paid.
6. The telephone bill has to be paid.
7. The bill for cartage has to be paid.
8. Interest on invested capital must be considered.
9. Depreciation of tools and replacement of them must be considered.
10. Percentage of bad accounts must be considered.

These may not be all the items, and probably are not, that go to make up the major item of overhead charges, but they are sufficient in number to cause each one of us to realize the supreme importance of this division of our cost and how absolutely foolish it is for us to assume that we can keep on in business without making any charge for it.

It is just as surely a part of our cost as any article of merchandise which we estimate to furnish. In amount it will vary according to the extent of the business and the prudence or extravagance with which the business is conducted, but it is always there and cannot be lost sight of. Each one can determine for himself just how much of an item this is—experience has taught, those of us who keep an accurate account of such matters, that it is rarely less than fifteen per cent. of our gross volume of business.

In other words, if our gross sales amount to \$100,000 per year, our overhead charges probably amount approximately to \$15,000 and this \$15,000 has to be provided for before you can hope for any profit. It is a part of the cost.

With reference to item four, The Profit, men differ as to what they consider a proper amount, but nearly everyone agrees that it should never be less than ten per cent. It is our opinion that never less than fifteen per cent. should be charged, and this, on small jobs, is not sufficient.

It is well to remember that there are lean years as well as fat years and the percentage of profit must be of such extent as to average well over a long period, if we hope to keep going. So then, our cost should be made up as follows:

1. Merchandise.
2. Labor.
3. Overhead Charges.
4. Profit—not forgetting Overhead Charges—"How."

The Harland Engineering Company, power engineers and contractors, have removed from 26 Victoria Square to larger offices at 102 St. Antoine Street, Montreal.



### Combination Cable Terminal and Series Cut-out

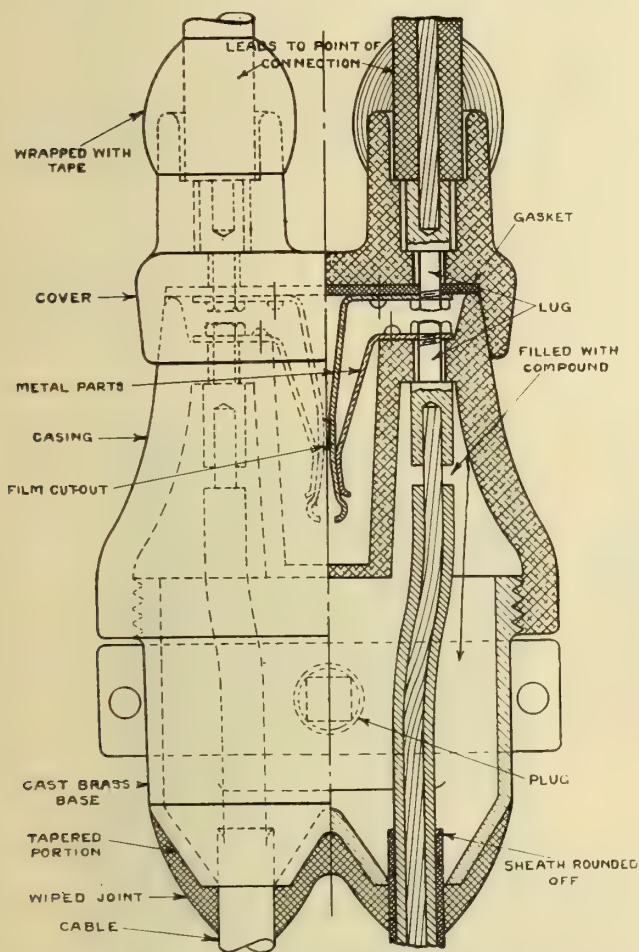
A somewhat new departure in the way of a combination cable terminal and series cut-out, has been recently put on the market by the Northern Electric Company. This cut-out can be used to advantage on all series arc and incandescent street lighting circuits up to 7,000 volts, and is particularly adapted for use inside the post pedestals of ornamental street lighting systems. By reference to the sketch, a general idea of the design can be obtained.

The cut-out consists essentially of three parts:—(1) A brass base in the form of a wiping sleeve; (2) a casing, and (3) a covering of insulating material, fitted with brass and phosphor bronze parts which pair in such a way as to provide the series cut-out feature. The rubber insulated leads

means of a special wiping sleeve connection, which allows for the entrance of four single conductor cables, this series branch connection can be made. The cut-out can also be used with double conductor cables or a combination of double and single conductor with the same facilities as with single, the only alteration necessary being the modification of the cable entrances in the brass base. The design besides presenting a very neat external appearance, possesses all the moisture resisting properties of a terminal in conjunction with the advantages secured by the cut-out devices described above.

### Cable for Loading and Unloading

The Toronto Hydro-electric System have recently installed a labor-saving device which has proved itself very effective in operation. This consists of a fixed Goliath crane which has been set up in the William Street store yard, where it is used for loading and unloading the heavy reels of cable, some of which weigh close on five tons each. One man is left in charge of the yard, and he is now able to take



METHOD OF CONNECTING COMBINATION TERMINAL AND SERIES CUT-OUT

to the lamp are connected to the cover, while the lead-covered cables of the main circuit enter the brass base and are held in place by means of a wipe joint, the casing and base being filled with compound, hermetically seals the ends of the cables and provides the cable terminal feature. When any particular lamp fails, a film cut-out, which is interposed between the metal parts on the cover, fuses and maintains the continuity of the main circuit. The cover is then removed which open-circuits the lamp and repairs can be made, the continuity of the circuit being maintained in this case by the springing together of the metal parts in the casing. When the lamp has been repaired the cover is simply shoved down into place, which again puts the lamp into circuit, neither operations necessitating any interruptions in the service.

On street lighting systems it is very often required to run a series branch off the main circuit up a side street. By



Goliath Crane in Hydro Store Yard.

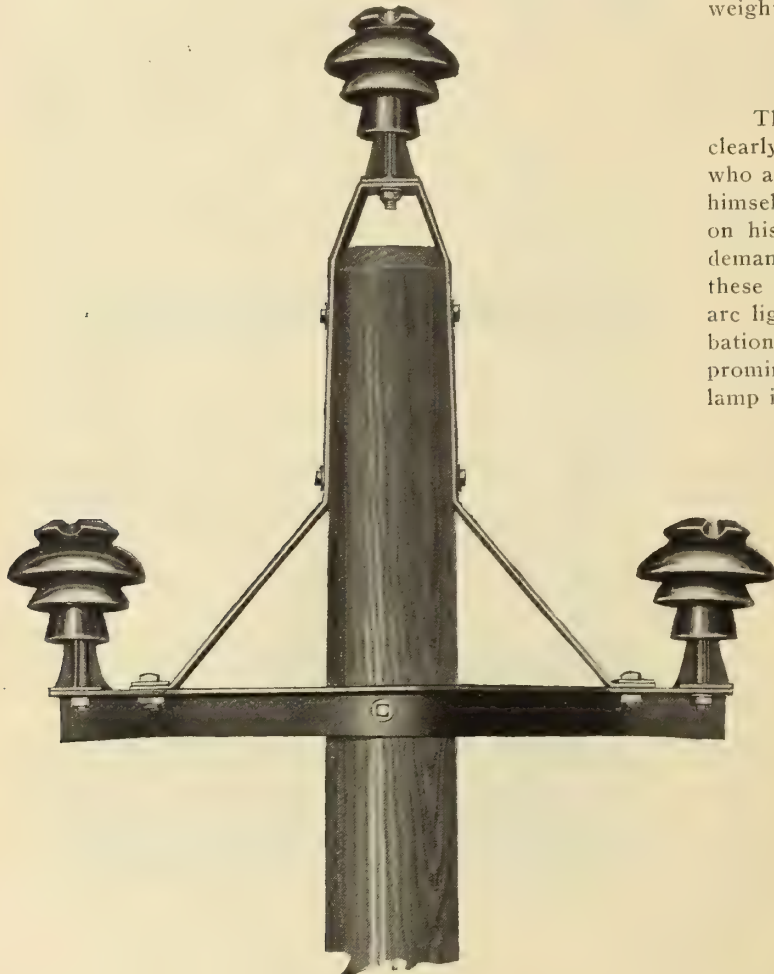
care of all the loading without assistance. Perhaps the most noteworthy feature of the crane is the gravity lowering device which obviates that "hauling down" of the load which is such a loss of time in the ordinary chain-block. The lowering motion is operated by a light hand chain and is rendered fool-proof by an automatic governor-brake which prevents an unsafely rapid descent of the drums. The steel bale is adjustable for width in order to accommodate various sizes of drums. This crane was designed, manufactured and erected by the Herbert Morris Crane & Hoist Company.

The paper insulated lead covered submarine cable to be supplied to Thomas Ross & Son, of Hawkesbury, Ont., by the Canadian British Insulated Company, is to be in two lengths of 2104 feet each. The diameter over the insulation is 2.225 inches and thickness of lead .150 in. The operation of lead covering each length occupied six hours continuous working, the quantity of lead used being  $5\frac{1}{4}$  tons. This is a record length for cables of this diameter.



### Keystone Triangle Arms

The Electric Service Supplies Company have placed on the market a new angle iron crossarm to be known as the Keystone Triangle Arm. As will be noted in the illustration it consists of an angle-iron crossarm with braces on either side which are continuous and which form a ridge iron over the top of the pole for a third insulator. The crossarm proper is shaped so as to allow the insulators to be on a line with the centre of the pole and so that braces and top insulator will also be centered. To install a Keystone triangle arm it is only necessary to shave off two sides of the pole at the top so that it will fit the brace, and to bore three holes. The crossarm proper does not require gaining. This small amount of preparation can be very readily and accu-



New angle-iron cross-arm.

ately done by means of a templet where a large number of poles are to be erected. On account of the superior bracing qualities of this crossarm it only requires three  $\frac{3}{4}$ -inch through bolts to lastingly secure it to the pole. On large installations the minimum time necessary to install these triangle arms should result in some appreciable saving.

Probably the most important feature of this new cross-arm is its great strength and ability to withstand the strain and stress of the heavy lines it is to support. This is particularly true where the pull is downward or at any lower angle therefrom. A careful analysis of the general construction of this crossarm will make this very evident. It is partly due to the equal distribution of weight on either side of the pole, and finally to the exceptional bracing and the improved design and great strength of every part. Other claims made for this crossarm are that the bolts are placed through the pole in opposite directions, giving exceptional rigidity to the installation; that the wires are in a true tri-

angle and all in different vertical planes, thus decreasing the possibility of a short circuit due to the breaking of an upper wire, which short circuit is quite possible from some of the varied methods now in use for supporting high tension transmission lines; that a maximum height of pole is secured in that the ridge iron is actually an extension to the pole, thereby allowing a shorter pole for a given height of wires. Ground wire supports or bayonets when used in connection with these cross arms are attached by means of the two through bolts which support the upper section of the triangle. They are of the offset type and are made from 3-in. x 3-in. x  $\frac{1}{4}$ -in. steel angle. Triangle cross arms are made from 3-in. x 3-in. x  $\frac{1}{4}$ -in. steel angle and  $\frac{1}{4}$ -in. x 3-in. flat steel. They are made for 3-phase circuits up to 35,000 volts and for 50,000 volt 3-phase circuits. Their approximate weight is 36 and 49 pounds respectively.

### Arc Lamp as An Incubator

The adaptability of the immigrant has never been more clearly exemplified than in the case of the English sparrow who apparently under the most adverse circumstances, makes himself thoroughly at home and does not hesitate to poach on his neighbors, be they human or bird, when his wants demand service. The accompanying illustrations show how these birds have utilized the most modern form of street arc lighting for artificial aid to their natural means of incubation. The pictures show hanging in the streets of a prominent American city, a Westinghouse metallic flame arc lamp into the top of which the sparrows have stuffed a mass



Arc lamp incubator.

of material for a nest. This electric incubator, if it may be so called, has successfully produced three hatchings of sparrows, who, apparently are not at all disturbed by the intense volume of light given off by the lamp or the heat generated at the top where the ventilating orifices are located. They seem to be willing to put up with a little discomfort in order to permit the mother bird to attend the social duties and outings of her kind, of which she would at certain periods otherwise be more or less deprived.

It must have been a kind hearted lamp attendant that would permit this accumulation to remain after one hatch-



ing, but it has been found that even where the nests are torn out and the material scattered away from the lamp selected by the colony, it is replaced in a surprisingly short time. A lamp of this type burns from 250 to 300 hours without a

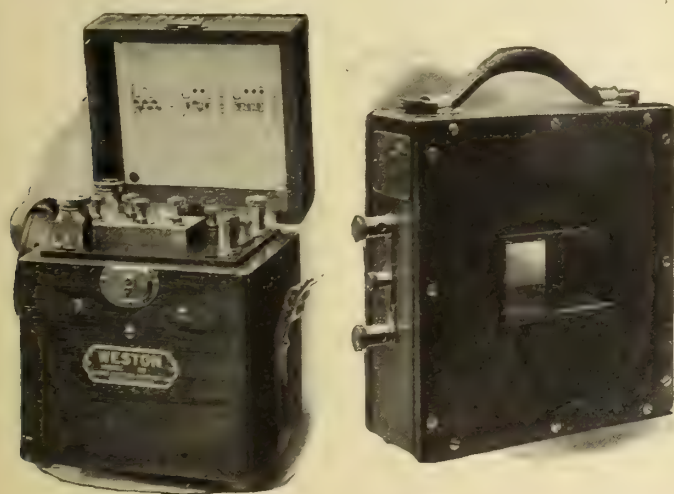


Arc lamp incubator.

renewal of the electrodes, or consequent inspection by the attendant, with the result that at this period of the year an interval of from four to six weeks may elapse between his visits, thus affording ample time for incubation purposes.

#### New Weston Instrument Transformers

Two new bulletins announcing and describing switchboard and portable instrument transformers of an exceptionally high order of merit have just been issued by the Weston Electrical Instrument Company, of Newark, N.J. It has of course been recognized that instrument transformers should be designed and made with a much greater degree of refinement than is necessary in commercial lighting and power transformers, and as might have been anticipated these new contributions to the art of electrical measurement by the Weston Company are worthy of recognition as standards of excellence. They represent the results of several years' careful and most thorough analytical study and experimental investigation of the many factors involved

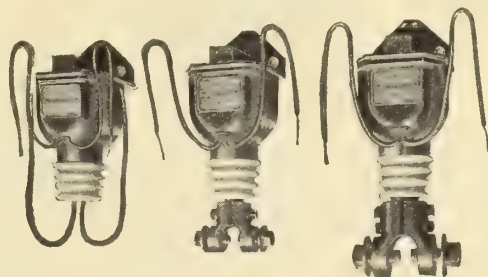


in developing and making instrument transformers capable of giving the highest degree of precision under the widely varying conditions incidental to their practical use.

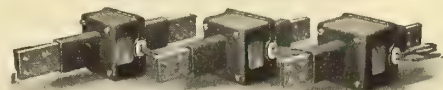
Two different Models of Portable Current Transformer are listed. One type has three self-contained primary windings and the other is of the inserted primary type, the ratio depending upon the number of turns of the primary that are passed through the aperture. There is also a portable

potential transformer which is made in various ranges. The switchboard models are made in several different types which vary in appearance with the ratio, the volt-ampere capacity and with the potential of the circuit.

The manufacturer emphasizes the point that these transformers are unequalled in precision, in design, in workmanship and reliability in service. Indeed, special stress is laid upon the accuracy, the ratios of transformation, and upon the fact that the design and proportions of the transformers are such that it is unnecessary to have instruments specially calibrated with the transformers in order to obtain the degree of accuracy to which high grade instruments are guaranteed when used without transformers. This feature is of



special interest in connection with tests with portable instruments, because in many quarters the impression has prevailed that no transformers could be made that would assure the users of the degree of accuracy for which a high grade portable instrument is designed, unless special precaution had been taken to calibrate a particular instrument with a



particular transformer. The new bulletins are numbered 1501 and 2001, the former dealing with Switchboard Instrument Transformers and the latter with Portable Types.

#### High Tension Wooden Pole Transmission

The Lindsley Bros. Company are just installing at their pole yard in Nakusp, B.C., a plant for treating the butts of their British Columbia cedar poles. For the past two years this company has been operating a similar plant at Priest River, Idaho, and last year treated over 5,000 poles. This year they have entered orders for over 12,000, their customers including some of the most prominent public service corporations in the United States and Canada, one of them being the municipal electric light plant of Ottawa, Ont. The treatment in this plant, as also in the Nakusp plant, just installed, consists in immersing the butts to a point 12 in. to 18 in. above the ground line in genuine *avenerius carbolinum* at approximately 200 deg. F. for a period varying from 10 to 20 minutes; the period of immersion varying with the condition of the poles and time of the year. It is found that this immersion is the most efficient and gives a penetration of the entire sapwood of the butt—the only place where decay is likely to affect the pole.

At the present time this company is treating some 7,000 poles for the Great Falls Power Company of Butte, Montana, which will be used in a 100,000 volt transmission line to be erected between Great Falls and Anaconda and designed to carry power for the electrification of the Chicago, Milwaukee and St. Paul Railway. About 4,000 of these poles, which are from 45 to 50 feet long, will be used for the main transmission line which will be of "A" frame construction with six unit, suspension type insulators. This will probably be



the highest voltage transmitted anywhere in the world on wooden poles and is all the more significant as the Grand Falls Power Company have had considerable experience with steel towers. At the present time they have a 60,000 volt line and an 80,000 volt line carried on wooden poles.

### Calorized Soldering Iron

Some time ago the Canadian General Electric Company greatly improved their electric soldering iron, both as regards its durability and general efficiency, by the introduction of a heating unit in which the heating material was made of "calorite" wire. This unit was adapted to operate continuously at a maximum heat (that is, running idly) for an almost indefinite period; soldering irons with this type of unit have been run idly for 10,000 hours continuously without noticeable injury to the unit. This company's soldering iron has now been further improved by the discovery of a treatment for copper which provides a copper iron which does not oxidize or corrode; the conducting properties of the copper tube are not impaired, however. This treated copper is named "calorized" copper because of its resistance to the corrosive effects of heat.

The working life of this calorized copper soldering tool is increased, it is claimed, many times over as com-



Varied sizes, soldering irons.

pared with the old type of soldering iron. The company claim the following features for their new unit.

1. Extreme durability of the "calorite" cartridge heating unit (ten thousand hours "running dry").
2. The calorized copper bolt, or tip, which has greatly increased life; the "calorizing" treatment rendering copper non-corrosive.
3. High efficiency, due to the location of the heating unit in the tip.
4. Renewability of copper tip and heating unit.
5. A cool handle, made of metal, and flexible.
6. A detachable cord connector on handle.

### Utilize Both Sides of the Street

A suggestion is made in the *Lighting Journal* that trial installations of street lighting often lose out in the eyes of the public where only one side of the street is lighted—that is, where poles are erected opposite or around a building selected as one suitably located to let the people know what ornamental street lighting will do to "brighten up."

The criticism which has been offered against using but one side of the street is based on the fact that such lighting centres the ordinary citizen's attention too much on the building lighted and at the same time the lighting, as far as the street is concerned, is but half accomplished.

A case of actual experience is cited where posts were put up, properly equipped with lamps, while the public was left to draw its own conclusions—except from the fact that some newspaper advertising was used to back up the campaign. The campaign was a failure and those who were enthusiastic about it had some little difficulty, quite naturally, in finding out what the trouble was. It was perhaps as much a matter of chance as anything that one of the mem-

bers of the citizens committee who had been pushing the proposition, got an expression from a merchant to the effect that he had driven past the installation in an automobile one night and had drawn the conclusion from the lop-sided exhibition of lighting that the plan involved the lighting of one side of the street only. Such a conclusion seemed hardly believable on the part of those who had supposed they had made their plans foolproof against every possible interpretation of such a nature as was actually drawn by the citizen who had seen only half of the street lighted and so concluded that that was all there was to it—except that it was to be extended along the street, on which the building faced.

The conclusion drawn from this particular experience at any rate, in the community where it so failed as to make it seem unfeasible to try it again, for some time to come anyway, was that if an exhibition is to be made of street lighting it should be made of sufficient completeness to give the most unimaginative citizen a very definite idea as to what the street will look like when everything is completed.

### Obituary

Mr. Roderick J. Parke died at his home, 179 Cottingham Street, Toronto, on August 25th. He had been ill for some time and his death was not unexpected. Mr. Parke was born in Cornwall, Ont., but has resided in Toronto for some 15 years, where he was probably best known through his connection with the firm of Parke & Leith, Canadian agents for the British Aluminum Company. A couple of years ago Mr. Parke resigned from this partnership to take up consulting engineering work and later accepted the position of managing director of the Automatic Electric Cook Company. He was an associate member of the Canadian Society of Civil Engineers.

### Large Stock of Motors on Hand

The Ferranti Electrical Company of Canada announce that they are in receipt of a large stock of standard motors from the Bruce Peebles Company which shipment arrived only a day or two before war was declared between England and Germany.

It is encouraging to note that Tramways, Limited, the company which proposes to build the inter-urban line in the Edmonton district, announce that they are prepared to proceed with the project as soon as arrangements can be finally completed by the city council. It was feared that the money for the undertaking would not be forthcoming, but this idea has been dispelled by definite assurance from New York city. It is expected that the firm will employ about three hundred men and eighty teams at the outset.

J. D. Lachapelle & Company announce that they have recently been appointed sole Canadian representatives for the Morey Flux & Chemical Company, of Parkesburg, Pa., who specialize in the manufacture of welding material and welding flux as well as chemicals used for this purpose. This welding material and flux are used for electric arc welding, oxy-acetylene welding, and gas welding of all descriptions.

Mr. C. H. Rust, city engineer of Victoria, was in Vancouver recently conferring with Mr. G. R. G. Conway, chief engineer of the British Columbia Electric Railway Company, respecting the Johnson Street bridge at Victoria. The railway company wish to have the plans of the structure altered to meet the requirements of their heavy electric locomotives. The additional cost will not exceed \$50,000.



**Reduce Price September 1**

The Onward Manufacturing Company, of Berlin, announce that they are reducing the price of their Eureka machine to the extent of \$5.50. The new price takes effect on September 1.

**New Companies**

The Montcalm Electric & Manufacturing Company, Limited, has been incorporated with a capital of \$99,000 and head office Rawdon, Quebec.

The New Glasgow Electric Manufacturing Company, Limited, has been incorporated with capital stock \$99,000 and head office New Glasgow, Que.

The Forbes Electric Company, Limited, has been incorporated with head office Saskatoon. Capital is \$10,000.

**Trade Publications**

**Electra**—Folder issued by the Canadian General Electric Company describing Electra carbons for moving picture machines.

**Welding Materials**—Small booklet issued by the Morey Flux & Chemical Company, Parkesburg, Pa., describing welding material, welding flux and chemicals as manufactured by this company.

**Railway Motors Gears and Pinions**—Bulletin No. A4199 issued by the Canadian General Electric Company. Well illustrated and contains much interesting information on the subject of gears and pinions.

**Protection**—Folder issued by the Railway & Industrial Engineering Company, Greenburg, Pa., describing the Burke series horn-gap lightning arrester. The Ferranti Electrical Company of Canada are Canadian representatives.

**Work Done**—A publication issued by Westinghouse, Church, Kerr & Company, of New York, describing with illustrations a few of the industrial installations recently carried out by this firm of engineers and constructors.

**Electricity in Coal Mines**—Bulletin No. 48011 issued by the Canadian General Electric Company illustrating and describing at length suitable machinery, and a number of actual installations showing the application of electricity to the mining of coal.

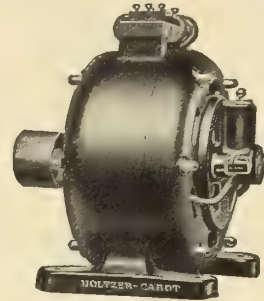
**Trolley Guards**—Folder issued by the Ohio Brass Company, Mansfield, Ohio, describing and illustrating National Railroad Trolley Guard of which this company claims there is now over 100,000 feet in service protecting grade crossings on many prominent roads.

**Badger Engines**—For gas, gasoline, or kerosene, are described in a catalogue issued by Canadian Allis-Chalmers, Limited. These engines are made in sizes from 2½ to 30 h.p. and are particularly well adapted for isolated electric plants. They are built by the Christensen Engineering Company.

**"Advertising that helps you Sell,"** a bound collection of advertisements placed in popular magazines by the Westinghouse Electric & Manufacturing Company. The pamphlet includes advertisements of domestic and industrial applications of electricity and is being distributed to central stations and dealers to inform them of the service furnished by this company.

**"The Young Man and the Electrical Industry"**—A story written by James H. Collins, the well-known magazine writer, which has just been issued by the Westinghouse Electric & Manufacturing Company. The little book deals with the opportunities afforded a young man in this industry and the different lines in which he may direct his activities as exemplified by the works of the Westinghouse company. This company announce that they will supply a copy to anyone interested in the development of young men.

# Is Our Motor Liberally Rated?



## Listen!

A yesterday ago, a ½ H. P. motor of a certain make broke down. Its duty was such it couldn't be spared. The local electrician endeavored to borrow another but without success. He decided to try out a Holtzer-Cabot ½ H. P. motor he had in use on a vacuum cleaner. This is what he wrote us afterward:

"It would have been a pleasure to one of your salesmen to have seen that motor. It picked up the load—a good one for the other motor—and handled it without the slightest suggestion of a fuss of any sort."

### The Holtzer-Cabot Electric Company

Boston, Mass.

Chicago, Ill.



Why not sell more day current?

### Simplex Electric Household Ranges

make a strong appeal to the housewife for summer use. There must be many homes in your territory in which a Simplex Range could be sold, if its advantages were known. There is a size for every purpose, from the smallest kitchenette to the largest country house. You do yourself a good turn every time you recommend and sell a Simplex Range. It blazes the path for other Simplex goods and larger use of day current.

### SIMPLEX ELECTRIC HEATING CO.

Mrs. of Everything for Electric Heating and Cooking  
BELLEVILLE, ONT.

CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.  
SAN FRANCISCO, 612 Howard St.

Member of THE RICE LEADERS OF THE WORLD ASSOCIATION

# Tenders

A few dollars spent in advertising your proposals in the

## Contract Record and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.



# Current News and Notes

## Comber, Ont.

The ratepayers unanimously carried a by-law to raise \$4,500 for a distribution plant and to close an agreement for a power supply with the Hydro-electric Power Commission of Ontario.

## Dartmouth, N.S.

The Dartmouth & Cow Bay Electric Railway has received an extension of time on its franchise from the Nova Scotia Legislature to build this projected railway from Dartmouth to Cow Bay Beach, Halifax County, N.S.

## Fort William, Ont.

Plans of the new sub-station installation have been received from the Hydro-electric Power Commission of Ontario, and the Canadian General Electric Company have been requested to rush work on the new motor-generator.

## Galt, Ont.

A contract has been signed by the Canadian Cereal Company for 250 h.p. of electric energy. This is said to be the largest contract yet signed by Galt for hydro power. A number of motors are being purchased by the Cereal Company from the Canadian General Electric Company.

## Montreal, Que.

Under the sale by auction on September 22 of the main assets of the East Canada Power and Pulp Company, Limited, Murray Bay, P.Q., and of shares and bonds of the Labrador Electric and Pulp Company, the liquidator will dispose of the benefits and obligations with respect to lighting contracts now existing.

Earnings of the Shawinigan Water and Power Company continue to show increases. For the month of July the total was \$141,992, a gain of \$6,726 over July, 1913, and \$37,892 higher than in the same month two years ago. Up to the end of July this year the earnings were \$992,264, an increase of \$57,835 as compared with the seven months of 1913 and of \$274,308 as compared with the same period in 1912.

The Cedars Rapids Manufacturing & Power Company have placed an order for three car loads of special large cross-arms for their main transmission line. These are to be of British Columbia fir and will be supplied by the Barnes-Lindsley Company, of Portland, Oregon, through their Canadian agent, J. D. Lachapelle & Company. These cross-arms are to be treated with arsenious carbide.

Tenders have been received by the board of commissioners for the installation of certain underground cables for the fire alarm department.

## Ottawa, Ont.

An Order in Council was recently passed requiring that all electrical installations in all Dominion parks must be in accordance with a set of rules and regulations based on those of the Hydro-electric Power Commission of Ontario. These rules and regulations are printed in the official government gazette.

## Owen Sound, Ont.

The Hydro-electric Power Commission of Ontario are calling tenders for the purchase of timber and the clearing of timber and swamp lands in the vicinity of Eugenia Falls.

## Regina, Sask.

The following telephone companies have been incorporated in Saskatchewan:—Bennett Rural Telephone Company, Limited, Craik; Deep Lake Rural Telephone Company, Limited, Indian Head; Lewiswyn Rural Telephone

Company, Limited, Raymore; Earnscliff Rural Telephone Company, Limited, Ellisboro; Glenavon Rural Telephone Company, Ltd., Glenavon; Foxbury Rural Telephone Co., Limited, Craik; Crescent View Rural Telephone Company, Limited, Hantley; Success Rural Telephone Company, Limited, Melville; Saskatchewan River Rural Telephone Company, Limited, Outlook; Cedoux Rural Telephone Company, Limited, Cedoux; Dewey Rural Telephone Company, Limited, Macoun; Paswegin Rural Telephone Company, Limited, Paswegin; Willow Hill Rural Telephone Company, Limited, Davidson; Butterson Rural Telephone Company, Limited, Butterson; South Melfort Rural Telephone Company, Limited, Melfort; Belvidere Rural Telephone Company, Limited, Cantuar; Osage Telephone Company, Osage.

The operation returns of the municipal electric railway, Regina, for the week ending August 8th, are as follows. Revenue, \$3,980.70; passengers carried, 92,059.

## St. John, N.B.

A submarine telephone cable has just been laid between East and West St. John by the New Brunswick Telephone Company. This is a 60 pair cable something over 2,000 feet in length. Up to the present time telephone connection between East and West St. John has been by way of the suspension bridge.

The St. John Railway Company have received two new cars for addition to their rolling stock.

## Shoal Lake, Man.

In connection with the new electric light plant to be installed in Shoal Lake a contract has been awarded to the Accumulator Lighting Company, Limited, of Winnipeg, for a 120-cell storage battery equipment which will carry the load at off-peak hours.

## Toronto, Ont.

The date on which the vote will be taken in the different municipalities on the question of a municipal electric railway service through the Markham, Port Perry and Uxbridge district has been extended one month from September 21 to October 19. The somewhat unsettled condition of the electorate and the difficulty of procuring speakers during the past two or three weeks has rendered this postponement necessary.

The Board of Control has asked the local hydro-electric commission to rush work on their large transformer pits as these constitute considerable obstructions in the business sections of the city.

## Valcartier, Que.

The military camp at Valcartier is being supplied with water by duplicate electrically driven pumps having a capacity of 80,000 gallons per hour. Pipes are being laid over the camp ground for a general water supply.

## Walkerville, Ont.

It is announced that negotiations have been completed for the purchase by the municipality of the plant of the Walkerville Light & Power Company. This will be utilized in connection with Niagara power soon to be delivered over the high tension line of the Hydro-electric Power Commission of Ontario.

## Winnipeg, Man.

Plans are being prepared by the Winnipeg, Selkirk & Lake Winnipeg Railway Company, a subsidiary of the Winnipeg Electric Railway Company, for a new sub-station at Stony Mountain.



SIEMENS BROS. DYNAMO WORKS

SIEMENS BROS. &amp; CO.

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SIEMENS

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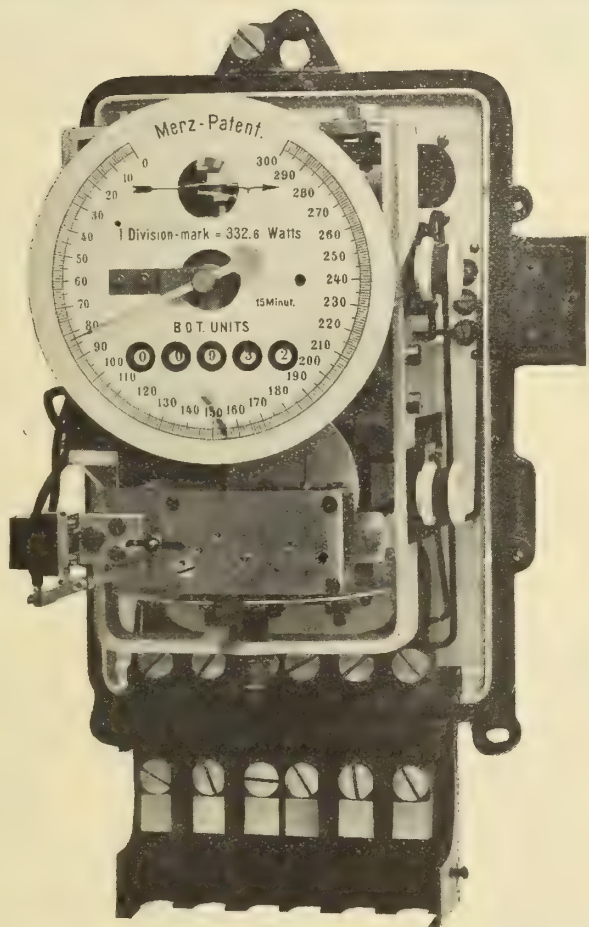
SIEMENS - SCHUCKERT

SIEMENS &amp; HALSKE

## What the Meter Does

1. Gives the kilowatt hours.
2. The highest load demanded in watts on a time average of say 15, 30 or 60 minutes.

The accurate measurement of these two quantities enables a true load factor system of charging to be adopted.



## What can be Done With the Meter

1. Charge an annual sum per K. W. or Horse power year to cover capital and standing costs.
2. Charge a low straight rate per K. W. hour based on running costs and profit required.

## These Meters are Approved by the Board of Inland Revenue

Siemens combined integrating and maximum demand meters.

We have in STOCK three phase meters suitable for 110 volts and 550 volts for 25 and 60 cycle circuits, also meters for use with instrument transformers for large capacities.

# Siemens Company of Canada Limited

HEAD OFFICE:

Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING  
TORONTOMcARTHUR BUILDING  
WINNIPEG



# Condensed Department

## Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

## The Electrical Commission of the City of Montreal

is prepared to receive applications for the position of Engineer in Charge of said Commission. Knowledge and experience are required in designing and laying of underground conduits. Full particulars of experience and qualifications should accompany. State salary expected and length of experience.

Applications, in writing, to be made to

SECRETARY,

1005-1009 New Birks Building,

16 Montreal, Que.

## EMPLOYMENT WANTED

Electrical Switchboard Operator, married, desires change. Experienced in A.C. and D.C. work. Present position hydro plant, two years. References. Box 67, Electrical News, Toronto.

16-17

Electrical Engineer desires position. Experienced in Construction and Maintenance, Electric Light, Power and Railway Plants.

Box 73, Electrical News,

Toronto, Ont.

16-17

## SITUATIONS VACANT

Salesman and Designer for large Electric Fixture Manufacturer, competent to sell special work. Must be able to estimate costs and have knowledge of illumination. Excellent opportunity. Applications confidential. Apply Box 58, Electrical News, Toronto.

15-18

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# PATENTS

STANLEY LIGHTFOOT

REG'D PATENT SOLICITOR AND ATTORNEY

LUMSDEN BLDG. (COR. ADELAIDE & YONGE) TORONTO.

NEW BOOKLET OF COMPLETE INFORMATION FREE

(MENTION THIS PAPER) M. 3713

**Lamson, Welch & Company**

CHARTERED ACCOUNTANTS.

TRUSTEES - FINANCIAL AGENTS.

CROWN LIFE BUILDING.

JAS. F. LAWSON,  
HENRY J. WELCH.

TORONTO.

CABLE ADDRESS "LAWELCO"  
A.B.C. & WESTERN UNION.

## SECOND HAND ELECTRICAL MACHINERY

Bought, sold, rented, and exchanged. We have the largest stock in America. Send for our monthly bargain sheet showing complete stock with our prices.

**GREGORY**  
**ELECTRIC CO.**  
CHICAGO, ILLINOIS  
Established 1893

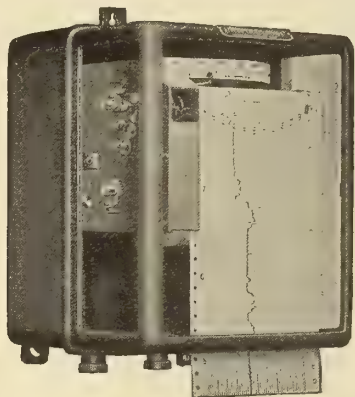
## Electrical Machinery

Motors, Dynamos, Generators,  
Electrical Pumps and Supplies.

Electrical Contractors,  
Motor Repairs.

**MAC**  
**ELECTRIC**  
**CO.**

52 Queen Street - OTTAWA



## The Indicating Meter That Plots the Curve

The chart is driven through the meter at a constant speed by a clock. The pen controlled by an electrical measuring element traces a curve of volts, amperes, watts, or speed on the paper.

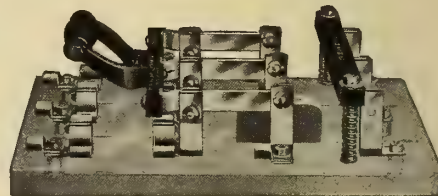
Competition demands efficiency. This meter may be mounted in the manager's office and arranged for connection to any motor in the plant. Anticipation of quitting time and slowness in getting to work are quickly detected. The moral influence of this device on the department foreman will quickly pay for the meter.

Get Our Efficiency Ideas 3120

**THE ESTERLINE COMPANY**

Engineers and Manufacturers  
Indianapolis, Ind.

## "CIRCLE T" A. C. Motor Starting Switches



Don't use an ordinary switch to start your motor, it is dangerous. The "Circle T" motor starting switches are specially designed for this work.

Start motor on unfused end and then throw into fused end when speed is up.

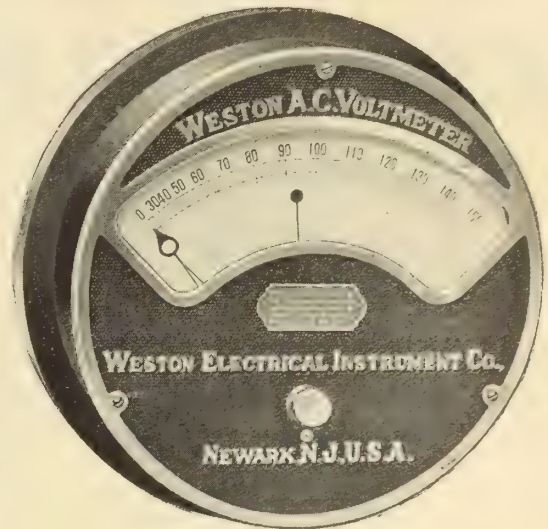
**The Trumbull Electric Mfg. Co.**

Plainville, Conn., U. S. A.





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A. C.



**Ammeters and Voltmeters, Wattmeters, Synchroscopes, Power Factor Meters and Frequency Meters,** constitute a line of Switchboard Alternating Current Indicating Instruments which is unequalled. Send for our Catalogs giving full description of these instruments. They are accurate—durable—dependable—and we stand back of them.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York office, and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

**WESTON ELECTRICAL INSTRUMENT COMPANY, Main Office and Works, NEWARK, N. J.**

Mr. Stanley Brown, 114 Liberty St., New York City.  
Badt-Westburg Elec. Co., 832 Monadnock Block, Chicago, Ill.  
Mr. F. E. Gilbert, 303-4 Hale Bldg., 1326 Chestnut St., Philadelphia, Pa.  
Mr. Geo. H. Moseman, 176 Federal St., Boston, Mass.

Mr. Milton Mill, 915 Olive St., St. Louis, Mo.  
B. K. Sweeney Electrical Co., 2910 Huron St., Denver, Colo.  
Mr. Frank E. Smith, 682 Mission St., San Francisco, Cal.  
Mr. S. C. Dinsmore, 1933 Dime Bank Bldg., Detroit, Mich.  
Walter P. Ambros Company, 1729

East 12th St., Cleveland, Ohio.  
A. H. Winter Joyner, Ltd., No. 76 Bay St., Toronto, Canada.  
Weston Instrument Co., Ltd., Geneststrasse 5, Schoneberg, Berlin, Germany.  
Mr. D. R. Petest, 415 Fourth Natl. Bank Bldg., Atlanta, Ga.  
Mr. Edwin Wortham, Suite 28

Allison Building, 8th St. and Main St., Richmond, Va.  
Montreal  
Winnipeg  
Vancouver  
Calgary  
Northern Electric Company (Limited)  
Weston Electrical Instrument Co., Audrey House, Ely Place, Holborn, London, E.C.



# Power Cables

Manufactured by

**British Insulated & Helsby Cables, Limited**

**PAID-UP CAPITAL, \$8,500,000.00**

HEAD OFFICE—PRESCOT, ENG. Works at PRESCOT, HELSBY and LIVERPOOL

Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and double steel tape armored cable for a working pressure of 660 volts. This cable is for laying direct in the ground without any protection whatever and is similar to that supplied to the cities of Saskatoon, Prince Albert, etc., etc.

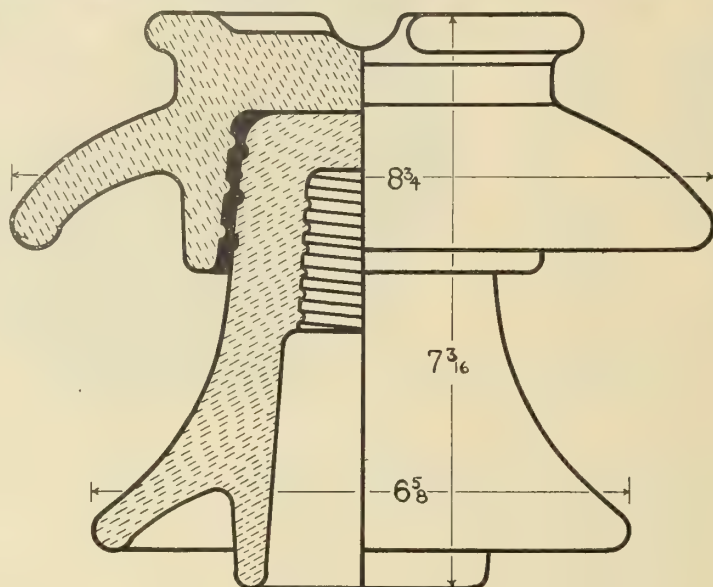
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SOLE CANADIAN REPRESENTATIVES :

**Canadian British Insulated Co.**  
LIMITED  
MONTREAL, QUE.



# CANADIAN INSULATORS



Number	133
Line voltage	30,000
Test voltage	100,000
Rain test	65,000
Leakage distance	$17\frac{3}{4}$ -in.
Pin hole	$1\frac{3}{8}$ -in.
Net weight	$10\frac{1}{2}$ -lbs.
Packed weight	12-lbs.
No. per crate	6

**The Canadian Porcelain Company, Limited**  
HAMILTON, - CANADA



## EVERYBODY IS DOING IT!

"THE METROPOLITAN WAY"

THE EQUITABLE LIFE BUILDING

"The Largest Office Building in the World" is to have a Switchboard built to order by

**The Metropolitan Electric Manufacturing Co.**

Long Island City

Just over the Bridge at 59th Street, New York City

Specialists in

**SWITCHBOARDS, PANELS and ELECTRICAL DEVICES**

CANADIAN AGENTS:

## ECONOMY ELECTRIC CO.

Bank of Hamilton Building

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# Tallman Fixtures

*They're different*



Bronze Standards

MANUFACTURED BY

**Tallman Brass & Metal Co.**  
HAMILTON, ONT.

# Use the Railway's Trolley Poles

as the basis of your new street lighting system. You can easily convert them into attractive

Mazda Lamp Standards or arc lamp supports by use of



## ERECO Combination Railway Lighting Pole Fixtures

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

Design No. 10127

**Electric Railway Equipment Co.**  
Cincinnati, Ohio

Designers

Canadian Representatives:

Dawson & Co., Limited, Montreal, Winnipeg

N. Y. Office, 30 Church St., Hudson Terminal Bldg.

Manufacturers



No. 6021 $\frac{1}{2}$ 15 $\frac{1}{2}$ " Moonstone Semi Indirect Bowl

**G**OOD and Efficient Lighting  
is an investment that should  
not be overlooked in any interior.  
The best is obtained with

## MOONSTONE GLASS

There is a particular design  
for every service.

# JEFFERSON GLASS COMPANY LIMITED

Head Office & Works  
TORONTO

Branch Sales Offices

{ MONTREAL,  
WINNIPEG,  
VANCOUVER.

# SAFETY



# FIRST

## FOR CONDUIT

# Xceladuct - Orpenite

Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by COPPER-PLATING and zinc coating.

Clean threads and smooth enamelled interior allows rapid fishing.

Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

Let us submit prices and particulars.

## Orpen Conduit Company, Limited

TORONTO, ONT.

MONTREAL, QUE.



## Everything Electrical Repaired NO JOB TOO LARGE

We specialize in the repair of all kinds of electrical instruments and machinery. Our large staff of experts enables us to give you prompt and efficient service.

Get our prices on the re-winding of motors and generators, over-hauling of switch boards, re-construction of power plants, etc.

One trial will convince you.

## KANALY ELECTRIC COMPANY

Phone Garry 4359

56 Princess Street

WINNIPEG



## PHANTOM LOADS

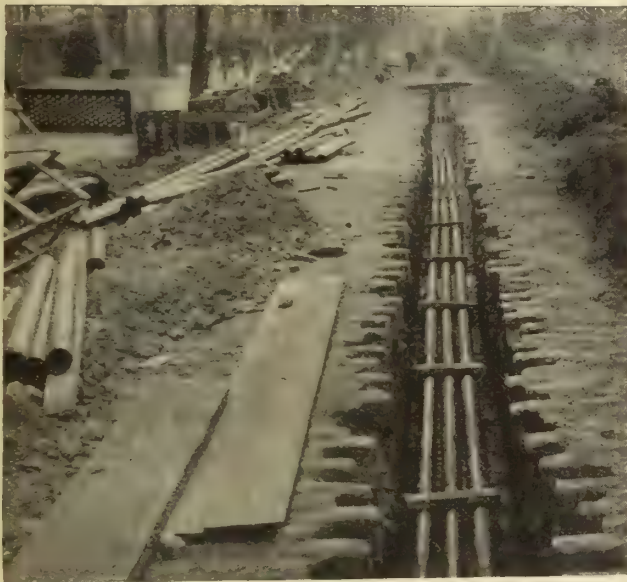
Portable and Laboratory Loads

The best that can be made.

Type B shown in cut.

Send for bulletin 19

**THE STATES CO.,** 15 New Park Ave., HARTFORD, CONN.



Manitoba Government Installation at Winnipeg.

7 foot Lengths.  $\frac{3}{8}$ -in. walls.  $\frac{3}{8}$ -in. joints. Absorption, 100 Hrs.,  $\frac{1}{4}$  of 1% Puncture Test 50,000 V. Electrolysis-proof—Water-proof—Gas-proof.

Comparison of above figures with other types of Fiber Conduit will show the superiority of our product.

## American Conduit Co.

East Chicago, Ind., U. S. A. 140 Nassau St., N. Y. City

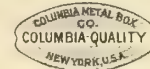
Distributors for Canada:

**Northern Electric Company**

LIMITED

Montreal, Halifax, Toronto, Winnipeg, Regina,  
Calgary, Edmonton, Vancouver, Victoria

## Columbia Quality Steel Cabinets and Cutout Boxes



The above trade-mark now appears on products made by this Company. It is a sign in itself justifying confidence. A reputation for quality, service and everlastingly fair treatment has been acquired for it after but seven years of life. Wherever you see the COLUMBIA-QUALITY trade mark you can safely conclude that the product bearing it is all that is claimed for it—and a bit more.

## Columbia Metal Box Co.

226-228 EAST 144th STREET,

NEW YORK

## M I C A

Canadian Amber

Indian Ruby

For Every Purpose

Cut or uncut, stamped to pattern. Selected to cut any size or in regular grades. Splittings, Washers, Gramophone Discs. I also carry the largest stock of Stove Mica in Canada.

Write for prices and samples.

## S. O. FILLION

Miner, Importer and Wholesale Dealer

86-88 Duke St. - OTTAWA, Canada

BRANCHES—34 West 33rd St., New York Kodarma, Bengal, India

## ASK US about

## Efficient

## Lighting

for your streets, factory, warehouse  
or yard

## A. H. WINTER JOYNER, Ltd.

76 Bay Street, Toronto

"Consult A Specialist"





# Electrical Supplies Warehouse Space Adelaide St. W., Toronto

This new warehouse building is well suited for the displaying and stocking of electrical supplies.

It is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

## Special Features

Centrally located at Adelaide and Charlotte Streets.

Light on four sides

Passenger and freight elevator

Vaults

Low insurance

One block from four car lines

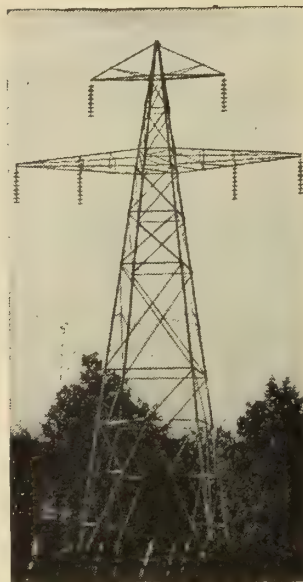
Floor area, 6,300 sq. feet, each floor.

*For further particulars ask*

## R. A. Donald

Union Bank Building - Toronto

# TRANSMISSION TOWERS



Hot Galvanized or Painted

Estimates furnished on application

## The Canadian Bridge Co.

Limited

Walkerville, Ontario, Canada

MANUFACTURERS OF

STEEL RAILWAY AND  
HIGHWAY BRIDGES

Structural Steel of all kinds

### DOUBLE CIRCUIT TOWER

One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario. Transmitting a 110,000 volt current from NIAGARA FALLS to the principal cities of ONTARIO. The largest single order of Transmission Towers ever placed.

# → No. 21 ←



## New Catalog



Listing

## 16 Distinct Types

of

## Panel Boards

with which  
innumerable combinations  
can be made

## Steel Cabinets

## Switchboards

— Meter —

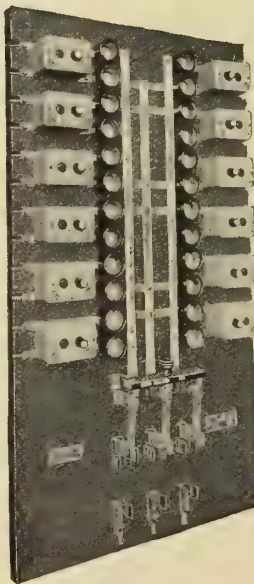
## Control Panels

## Knife Switches

30 to 5000 ampere

DO IT TODAY!

WRITE FOR COPY



## FRANK ADAM ELECTRIC CO.

ST. LOUIS, MO., U. S. A.



# Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

*Prompt Shipments from Canadian Factory.*

**BOSTON INSULATED WIRE & CABLE COMPANY**

Canadian Office and Factory, HAMILTON, ONT.

## “UNILETS”

are drawn from steel and possess many merits which are an absolute necessity for up-to-date conduit work. For durability, neatness, space for making wire connections, “Unilets” meet all requirements. “UNILETS” are mechanically right. The conduit is steel, why not the fitting? Try them on your next job. A copy of our new catalogue should be before you. You cannot afford to be without it. Write us at once for your copy.



Cat. No. 9001—Rectangular Unilet.



Cat. No. 9002—Rectangular Unilet.



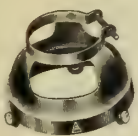
Type No. 2—Rectangular Unilet. Cat. No. 9002 with No. 7650 Receptacle.



Type No. 1 Octagon Unilet. Cat. No. 7501.



Type No. 4—Round Unilet with enclosed Snap Switch.



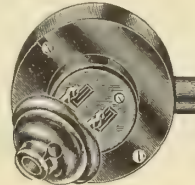
Cat. No. 7322—Shade Holder



Cat. No. 6906 Vapor-Proof Unilet.



Combination Plug Receptacle and Push Button Switch Unilet—Hubbell Plug Receptacle and Arrow E Push Button Switch Attached.



Type No. 1—4-inch Round Unilet with Two-phase Receptacle Attached.



Type No. 2—Switch Unilet. Cat. No. 6501. with Push Button Switch Attached.

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**APPLETON ELECTRIC COMPANY**

Main Office and Factory CHICAGO 212-214 N. Jefferson Street

For Sale in Canada by

The Mainer Electric Co., Ltd., Winnipeg

Marshall-Wells Co., Ltd., Winnipeg

Chapman & Walker Ltd., Toronto

## PORZELLANFABRIK HERMSDORF (Germany) S.---A.

Works at: Hermsdorf (S.---A.) and Freiberg (Saxony)

Largest Porcelain Insulator Works  
1,500 Hands

Known All Over the World  
36 Ovens

Specialties: High Tension Insulators, (Suspension Types) (Metal Covered Insulators)  
Insulators for Telegraphic and Telephonic purposes.  
Pressed Articles.

Representatives in Canada:

**WATSON JACK & COMPANY,**

**MONTREAL**



## SMALL TOOLS

TAPS CUTTERS  
DIES REAMERS  
HOBS DRILLS

Large Stock—Prompt Delivery

*Our Guarantee—Satisfaction or your money back.*

**Pratt & Whitney Co., of Canada, Limited**  
DUNDAS, ONTARIO

Montreal Winnipeg Vancouver

## ALUMINUM

Electrical  
Conductors

Ingot Sheet  
Wire Rod  
Tubing

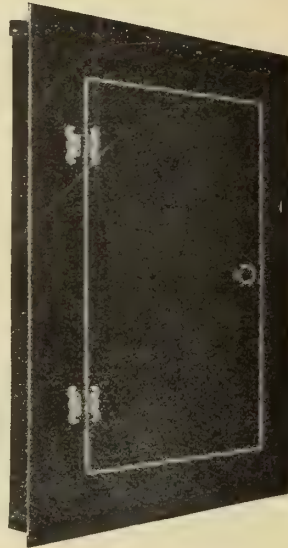
Northern  
Aluminum  
Company

Limited

1305-6 Traders Bank Bldg.

Toronto, Ont.

## SWITCH BOXES



We manufacture  
the Highest Grade  
Boxes on the Mar-  
ket.

### SERVICE

We guarantee prompt  
shipment.

Standard sizes carried  
in stock.

Special sizes made up  
immediately.

*Our prices are  
right.*

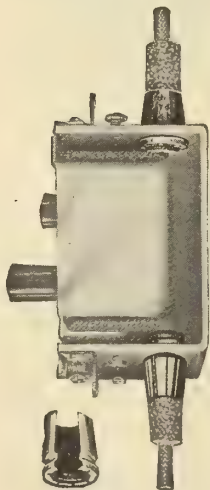
**John T. Wilson, Limited**

Toronto, Ontario

*Sales Representatives Wanted*

## UNIVERSAL BUSHINGS

### FOR FLEXIBLE TUBING



No. 1&3 Universal Bushings  
Patented

Meet and overcome the many difficulties in holding flexible tubing securely in switch boxes, cabinets, outlet boxes and junction boxes.

They are one-piece bushings, easily and quickly installed without the use of tools, and can be removed for inspection and replaced without injuring bushing or tubing. **THEY SAVE TIME AND TROUBLE.**

UNIVERSAL BUSHINGS are made in four sizes which cover every condition in wiring.

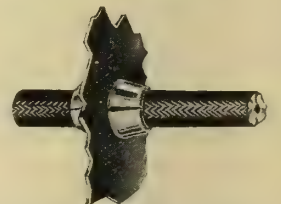
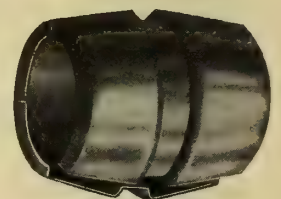
Nos. 1 & 3 for 5/8-in. knockouts; 1/4-in. and 7/32-in. tubing.

Nos. 2 & 4 for 3/8-in. knockouts; 1/4-in. and 7/32-in. tubing.

We also manufacture FLEXIBLE TUBING CLAMPS for holding tubing at wall and ceiling outlets where boxes are not used. **TRY THEM.**

Approved by National Board of Fire Underwriters

*Write for prices and samples of these "Money Savers"*



No. 2 & 4 Universal Bushings  
Patented

**New Process Specialty Company, Inc.**

MILWAUKEE,

--

WISCONSIN



**Quality** Do you realize that carefully made Electrical Goods cost the maker 10, 20 or even 30% more than those made to meet or beat the lowest priced materials that will pass? This is particularly true of

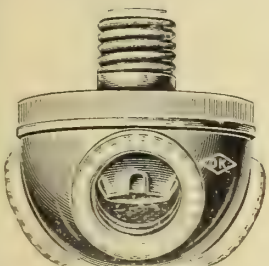
## MAGNET WIRE

THE STANDARD MAGNET WIRE CO., of Boston —whose product is sold only through us—test and fully guarantee every foot of wire they send out, and our prices are about the same as other first class manufacturers. Does quality or the above guarantee mean anything to you? We carry a large and complete stock.

# STUART - HOWLAND CO.

131 to 141 Federal St.,

BOSTON



No. A 498 [3 Light]



A 566

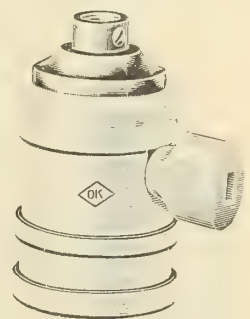
## SUPPLIES

(National Electric Code Standard)

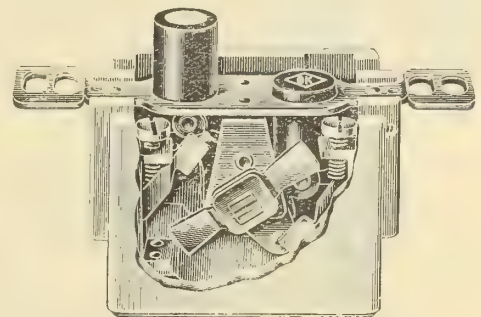


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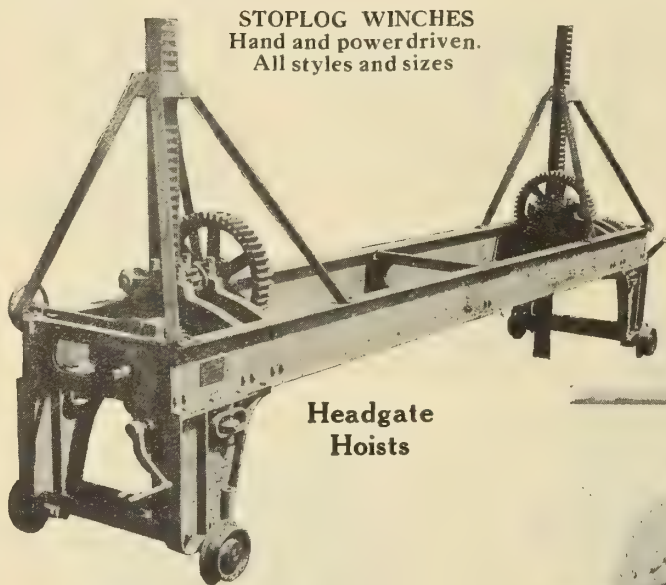
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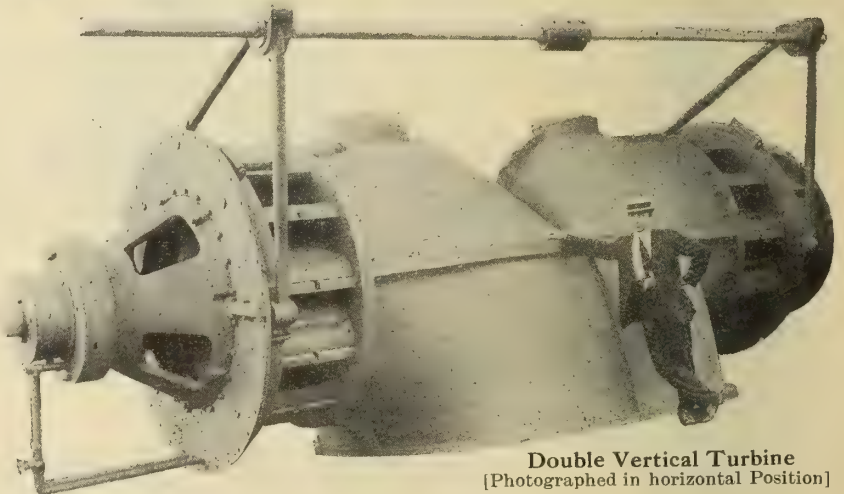


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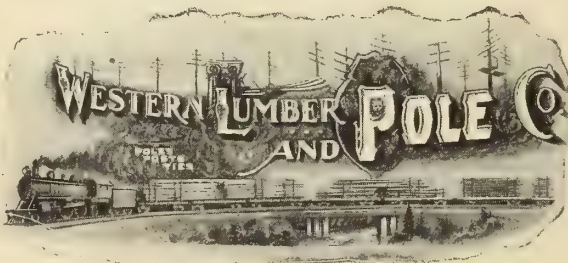
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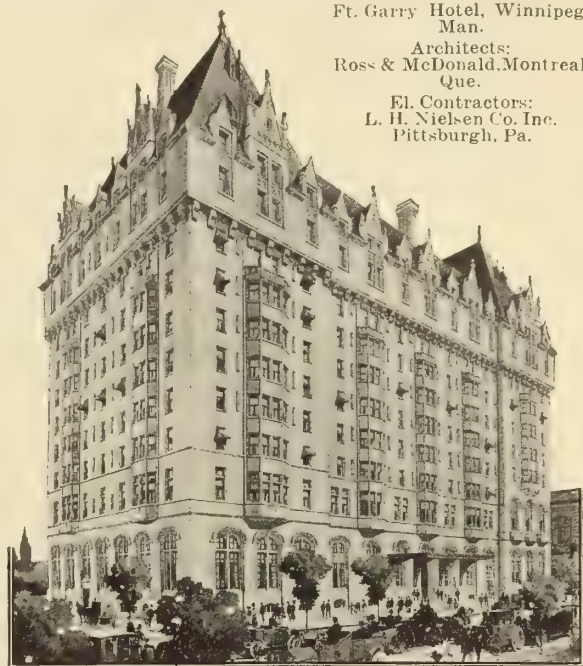
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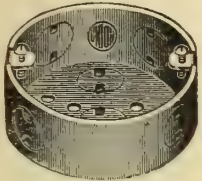
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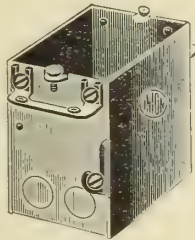


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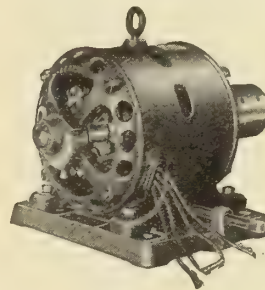
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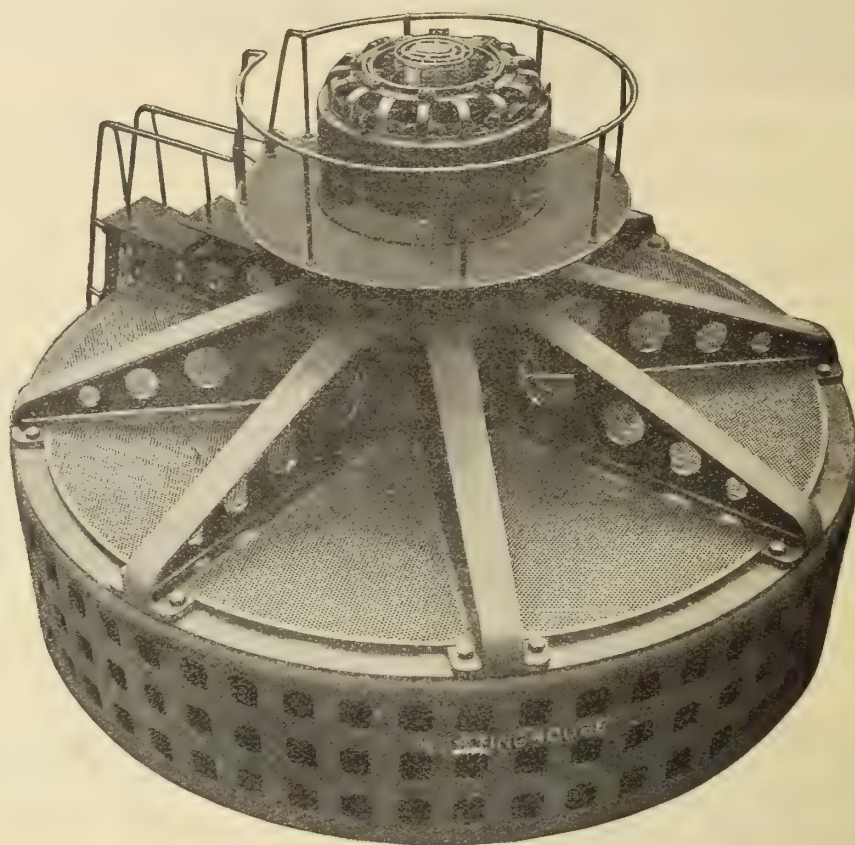
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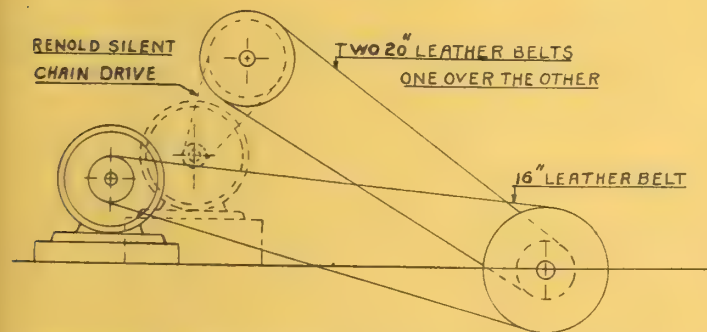
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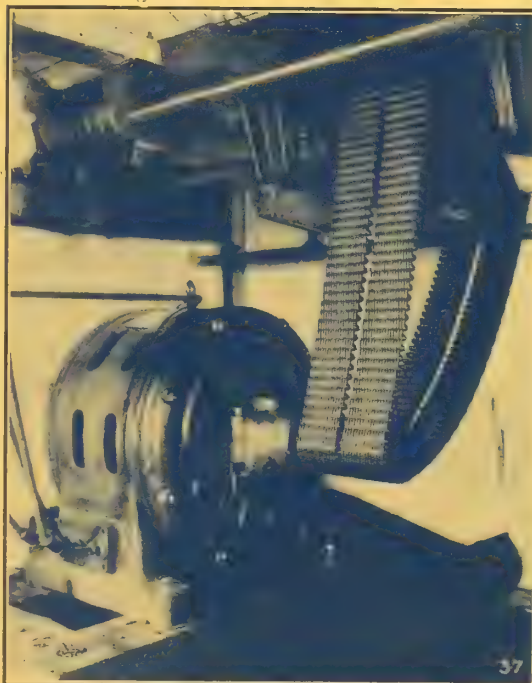
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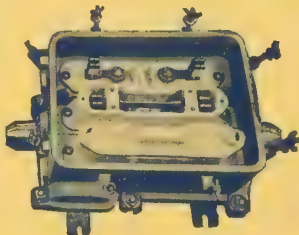


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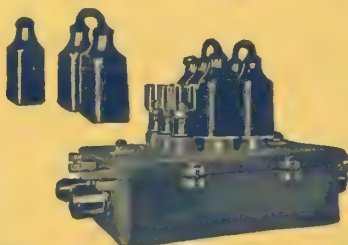
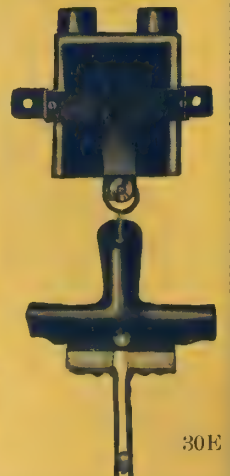
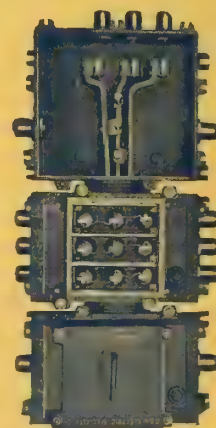


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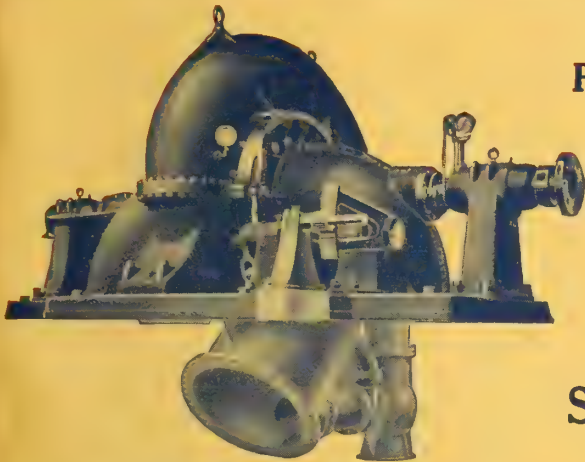
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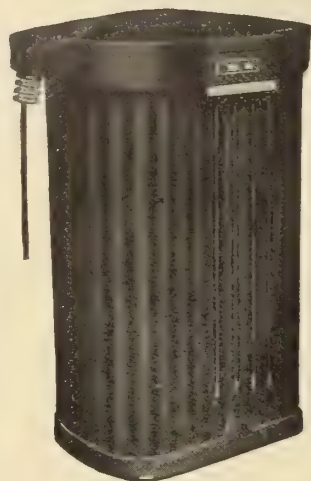
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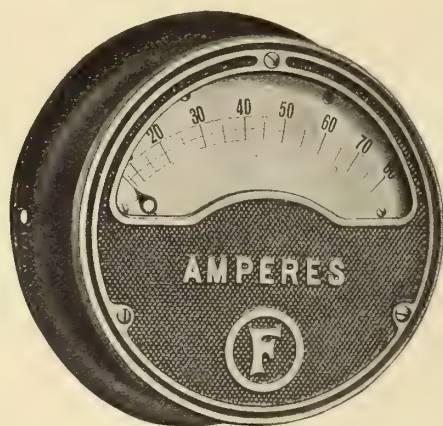
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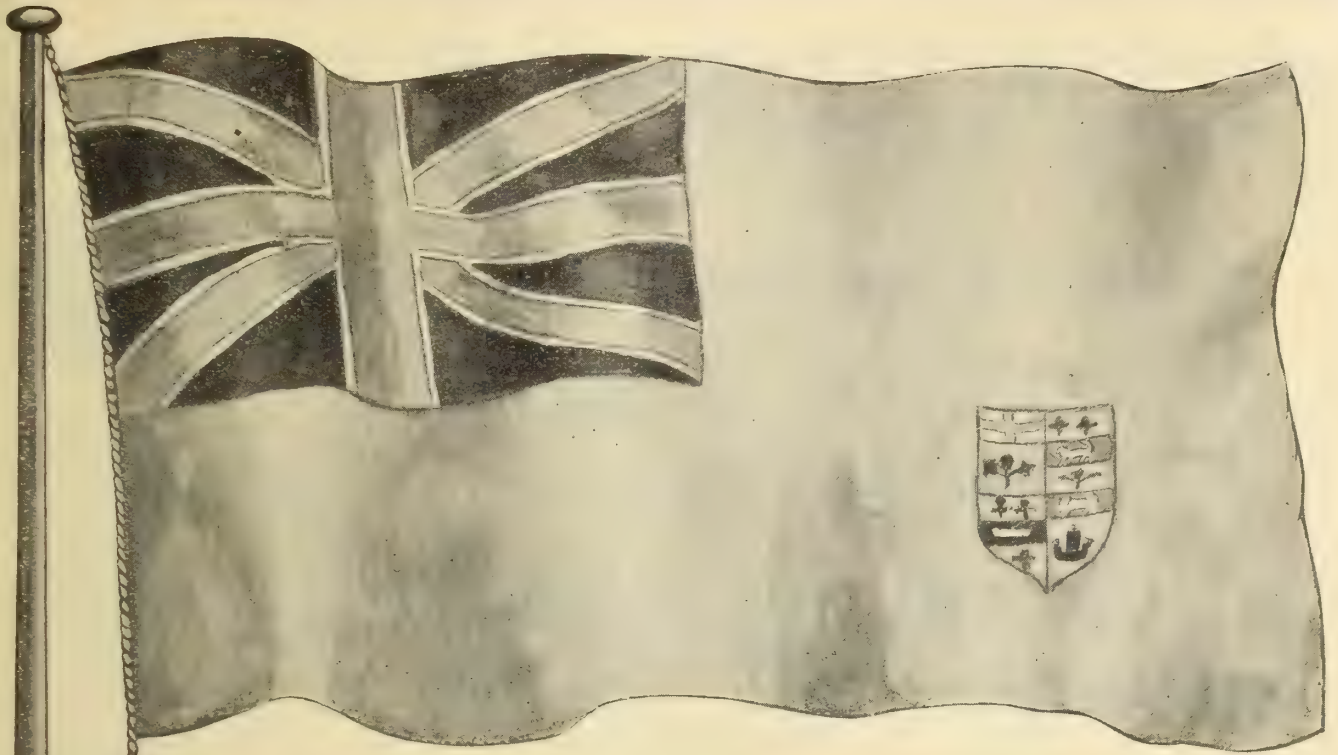
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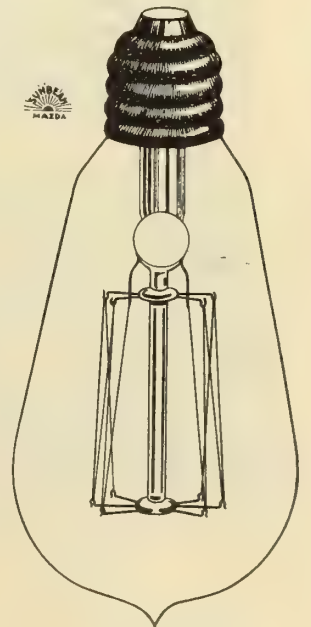
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**100 to 100,000**

The "CONDOR" Lamp is the *reliable* lamp and dealers will considerably increase their sales by handling it.

**WATCH YOUR STOCK**

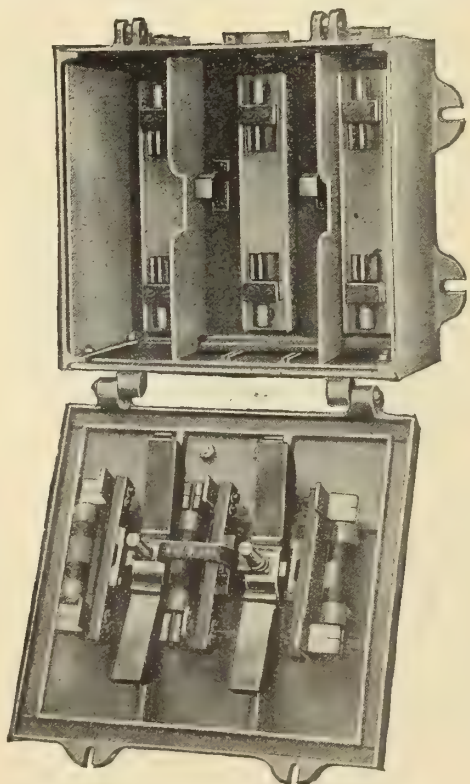
FOR THE COMING SEASON

*Mail Orders Receive Prompt and Immediate Attention.*

Sole Canadian Distributors:

**C. H. Basters & Company**

TORONTO 22 College St. ONTARIO



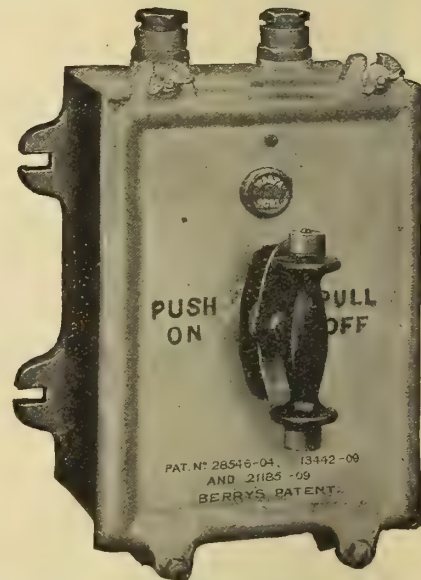
## The FIRE HAZARD

Do not think only of loss by fire, but guard your employees against electrical accidents.

**BERRY'S PATENT**

ironclad fuse-switch gear is used in every civilized part of the world, and is absolutely fool-proof.

Write for particulars to the sole agents in your territory:—



D. P. "Masta" Fused-Switch  
Weathertight Type.

**FEDERAL ENGINEERING Co., Limited**

90 Sherbourne Street TORONTO

**CANADIAN-BRITISH ENGINEERING Co., Limited**

324 Smith Street, WINNIPEG

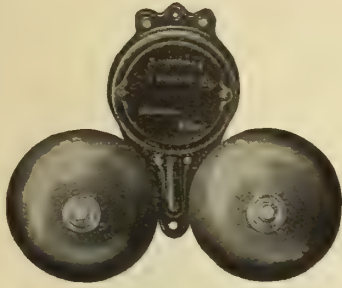
**GENERAL SUPPLIES, Limited**

122 Eleventh Avenue West, CALGARY

T. P. "Masta" Patent Fused-Switch, with  
National Standard Code Fuses.

Berry, Skinner & Company, 78 Upper Thames Street, London, E. C., England





## We Have a Bell For Every Purpose

There can be only one best and that is the Schwarze. No. 12 Common Magneto Extension for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire is all active. Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and very much louder, and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof.

Write for catalogue.

All resistances.

**Schwarze Electric Co., Adrian, Michigan**

Norton Telephone Co., Canadian Agents

**John Starr, Son & Co.**

Limited

158 Granville St. - HALIFAX, N. S.

## Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,  
CONDUIT, MOULDING, SWITCHES, CUT-  
OUTS, FIXTURES, ETC., ETC.

Large Stocks - Prompt Shipments

Write Us for Low Prices

## Street Illumination

By Multiples and  
Series

**Pemco  
Fixtures**

"The Practical Fixture"

Send for Bulletin No. 7

**Philadelphia Electric and  
Mfg. Company**

PHILADELPHIA, PA.

Canadian Representative

A. H. Winter Joyner, Limited  
76 Bay Street, Toronto

## Wm. Wurdack Electric Mfg. Co.

19 to 23 South Eleventh St., St. Louis, Missouri

Manufacturers of

**Switchboards — Panelboards — Cabinets, Etc.**

We are in position to make up your special requirements at a low cost—Write us for prices before placing your next order.



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**The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers**





The KING EDWARD School, South Edmonton, Alta. A "GALVADUCT" Building

# GALVADUCT

## "GALVADUCT"

The most perfect interior construction conduit on the market.  
Recognized as the standard of high quality.

Always specify "Galvaduct" or  
"Loricated" Conduits

## "LORICATED"

A high - class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply  
you—write us

# LORICATED

**Conduits Company Limited**  
Toronto - Montreal



# The Ideal Power Plant

## PLANTS NOW SUPPLIED OR ON ORDER

Town of Rapid City, Man.  
 " Russell, Man.  
 " Broadview, Sask.  
 " Cudworth, Sask.  
 " Grenfell, Sask.

Town of Gull Lake, Sask.  
 " Hanley, Sask.  
 " Herbert, Sask.  
 " Langham, Sask.  
 " Outlook, Sask.  
 " Oxbow, Sask.  
 " Strassburg, Sask.  
 " Wadena, Sask.  
 The Leader Publishing Co., Regina, Sask.

## For Town Electric Lighting, Water Works or Sewage Disposal

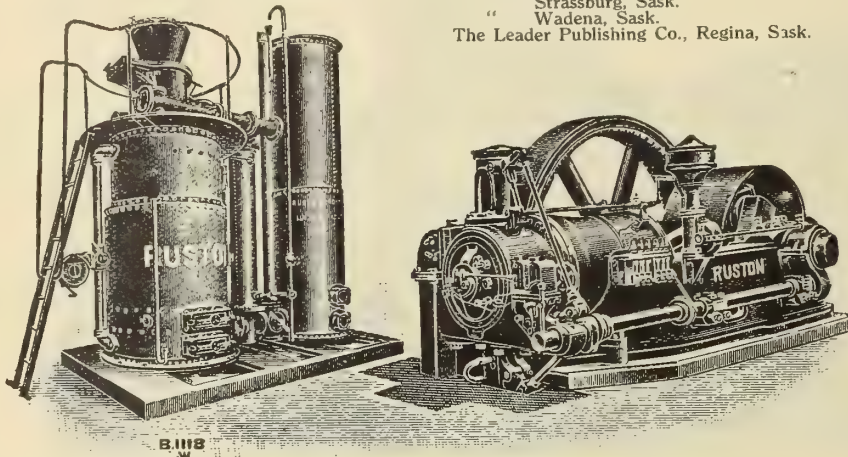
For Economy, Reliability, Ease of  
 Cleaning Without Stopping the  
 Plant, Clean and Cool Gas, Sim-  
 plicity, and for Generating Elec-  
 tricity, there is no Plant like the—

# Ruston

## Suction Gas Engine and Producer

For Anthracite, Coke and Charcoal

Patent Producers for using all kinds of Wood  
 Refuse—such as Sawdust, Shavings, Bark and  
 Wood Blocks may be used, either mixed up or  
 separately. Also Peat, and Lignite, etc.

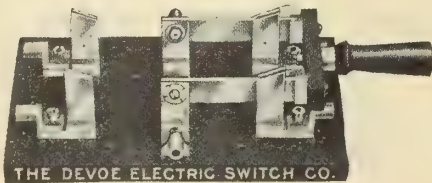
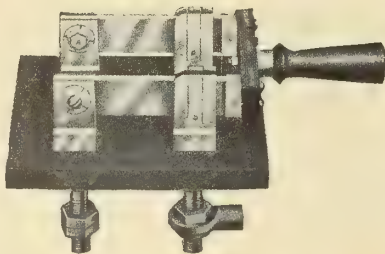


Ruston Suction Gas Producer for Anthracite and Ruston Gas Engine.

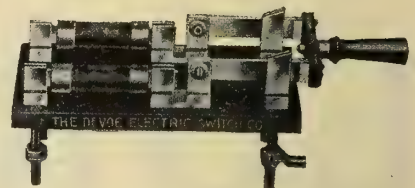
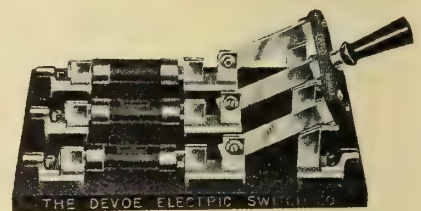
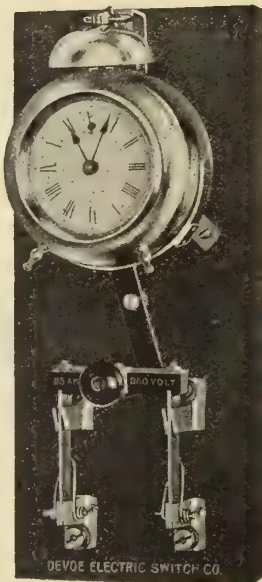
## British-Canadian Engineering & Supply Co., Ltd.

122 Phoenix Block, Winnipeg, Manitoba

# The Switch Specialists



By the concentration of experienced work-  
 manship on Switches, we are able to produce  
 them as a specialty and not a side line.



We build Switches, Switchboards and  
 Panels to any specifications. Prompt quo-  
 tations made on receipt of drawings and  
 data.

## THE DEVOE ELECTRIC SWITCH COMPANY

Office and Factory 157 Craig Street West, Montreal, Que.

Frank G. Scofield, Ontario Sales Representative, Lumsden Building, Toronto, Ontario



## Everything Electrical Repaired NO JOB TOO LARGE

We specialize in the repair of all kinds of electrical instruments and machinery. Our large staff of experts enables us to give you prompt and efficient service.

Get our prices on the re-winding of motors and generators, over-hauling of switch boards, re-construction of power plants, etc.

One trial will convince you.

## KANALY ELECTRIC COMPANY

Phone Garry 4359

56 Princess Street

WINNIPEG



## PHANTOM LOADS Portable and Laboratory Loads

The best that can  
be made.

Type B shown in  
cut.

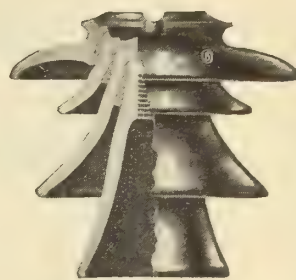
Send for bulletin 19

**THE STATES CO.,** 15 New Park Ave.,  
HARTFORD, CONN.

## O-B Pin Type Insulators



No. 10748—70,000 Volts



No. 10577—80,000 Volts

All sizes are designed and manufactured with the careful attention to detail which naturally results from our watchword

**“Quality First”**

The large number of satisfied users proves that our watchword pays.

*New Catalog No. 14 gives complete listing.*

**The Ohio Brass Company**  
Mansfield, Ohio, U. S. A.

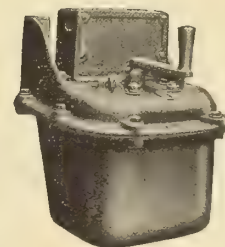


**E. A. C. Auto Transformer Starters** comply fully with Canadian requirements whether non automatic or automatic. In addition however both the switch and transformer are under oil, thus the thermo capacity of the oil is utilized to provide extra overload capacity in starting.

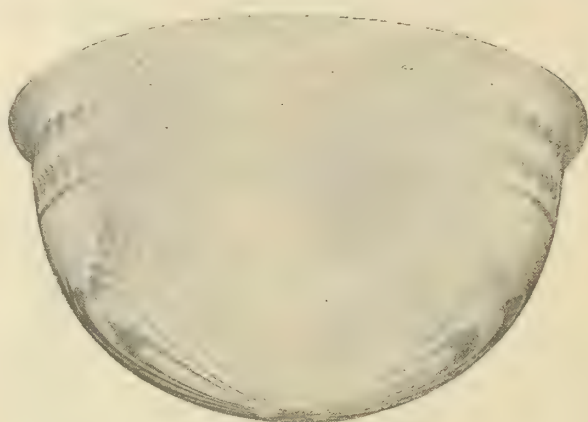
Reliable Agents  
Wanted in—  
MONTREAL  
TORONTO  
WINNIPEG  
VANCOUVER

**The Electrical Apparatus Co., Limited**  
Vauxhall Works :—South Lambeth Rd.  
LONDON S.W., ENGLAND

Telegrams:—Elapratus, London. ABC Code, 5th Edition







Etching No. 510

## Good, Efficient and Artistic Lighting

can be obtained only with the  
proper selection of Glass.

Our new deep etched and tinted Moonstone lines are  
made in many beautiful designs.

# JEFFERSON GLASS COMPANY LIMITED

Head Office & Works  
TORONTO

Branch Sales Offices

{ MONTREAL.  
WINNIPEG.  
VANCOUVER.

# SAFETY



# FIRST

FOR CONDUIT

# Xceladuct - Orpenite

Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by COPPER-PLATING and zinc coating.

Clean threads and smooth enamelled interior allows rapid fishing.

Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

Let us submit prices and particulars.

## Orpen Conduit Company, Limited

TORONTO, ONT.

MONTREAL, QUE.





**Made in  
Canada**

People must use  
**MAZDA Lamps this year**

Hundreds of families have let the old-fashioned carbon remain because, after all, a dollar or so more in the light bill doesn't mean much to the thoughtless and improvident. But this year **everybody** is going to cut out every cent of waste that can be detected. Their carbon lamps are going—sure.

That dollar or two they can save in the light bill is going to mean too much to neglect any longer. Be ready to sell them

*Northern Light* **MAZDA LAMPS**

They cut the cost of current to bed-rock, and your customers will be delighted to find their economy of money brings them a luxury of light--75% more than carbon.

NORTHERN LIGHT MAZDA LAMPS come packed 5 in a handy carton—the most attractive and sales-making carton on the market.

Every lamp is made in Canada and backed by the Northern Electric guarantee of quality.

Write us for prices and be prepared to cash in on a Mazda demand that will be unprecedented.

*Northern Light*  
**Mazda Lamps**

*Northern Electric Company*  
LIMITED

MONTREAL  
HALIFAX  
TORONTO

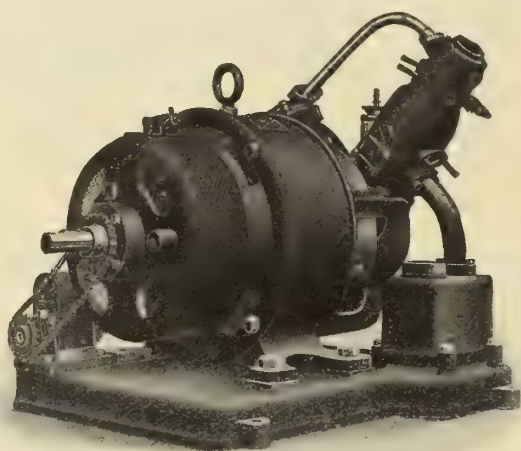
WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA



## Economical and Reliable

for lighting direct or battery charging. Noted for simple design, low initial cost, low running expenses and ease of management.



## VSM Gasoline Sets

Made in various sizes, from 2 K.W. upwards, for standard voltages. They are neat and compact, occupy very little space, require little attention and give most excellent results.

**The Electric & Ordnance**

Head Office for Canada  
Lewis Bldg., 20 Bleury St., MONTRAL



**Accessories Co., Limited**

Works, Aston, Birmingham, England  
Mr. J. F. I. Thomas (Representative)

# Pole Line Hardware

That Stands the Test of Time and Weather

**WE MAKE ALL ARTICLES REQUIRED**

**WIRES: Copper---Galvanized for Electrical Construction Work, etc.**

**ALL STYLES OF: Bolts, Nuts, Rivets, Washers and Screws, Pole Steps, Guy Clamps, Cross Arm Braces.**

Send us your specifications to quote on.

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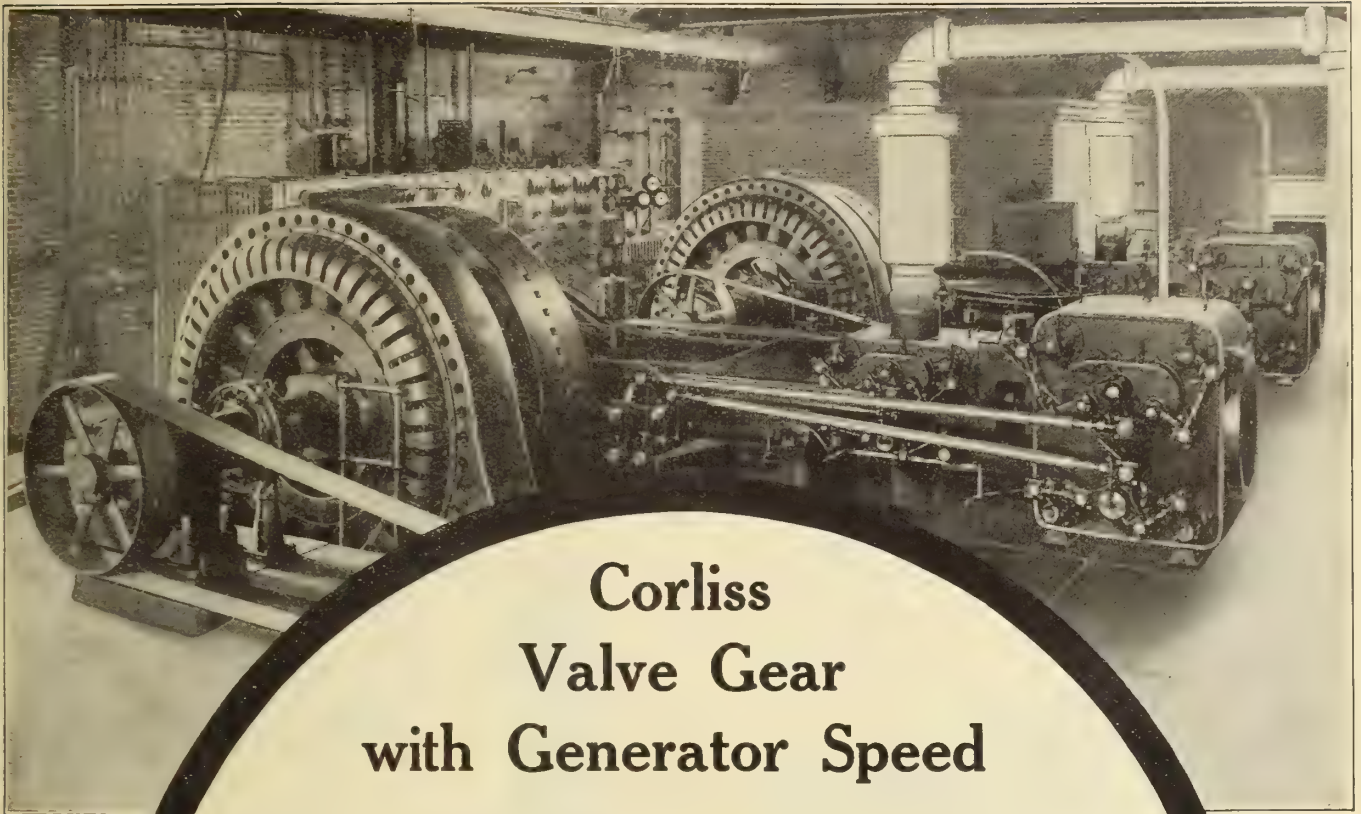
:::

Lowest Prices---Prompt Shipment.

The **Steel Company of Canada, Limited**

Hamilton Montreal Toronto Winnipeg Vancouver Victoria St. John, N.B. Halifax





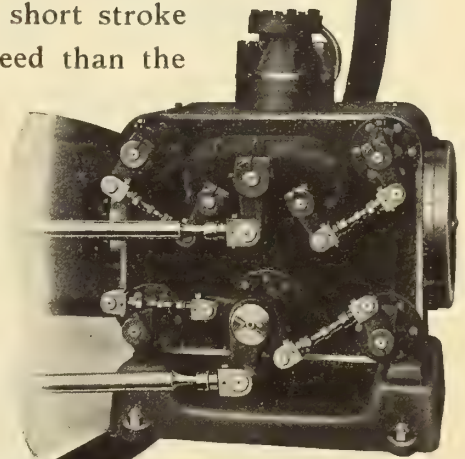
## Corliss Valve Gear with Generator Speed

This feature distinguishes

# Robb Corliss Engines

A simplified valve gear, multiported valves, short stroke and compact frame permit a much higher speed than the ordinary form of Corliss gear.

Half as many parts to wear, no springs, no dash pots, no latches, no cams, no disengaging parts, — but Corliss steam distribution and small clearances.



Scotch Boilers  
Vertical Engines  
Horizontal Boilers  
Water Tube Boilers

**INTERNATIONAL**  
ENGINEERING WORKS, LIMITED

FRAMINGHAM, MASS.

AMHERST, N.S.

Montreal

Toronto

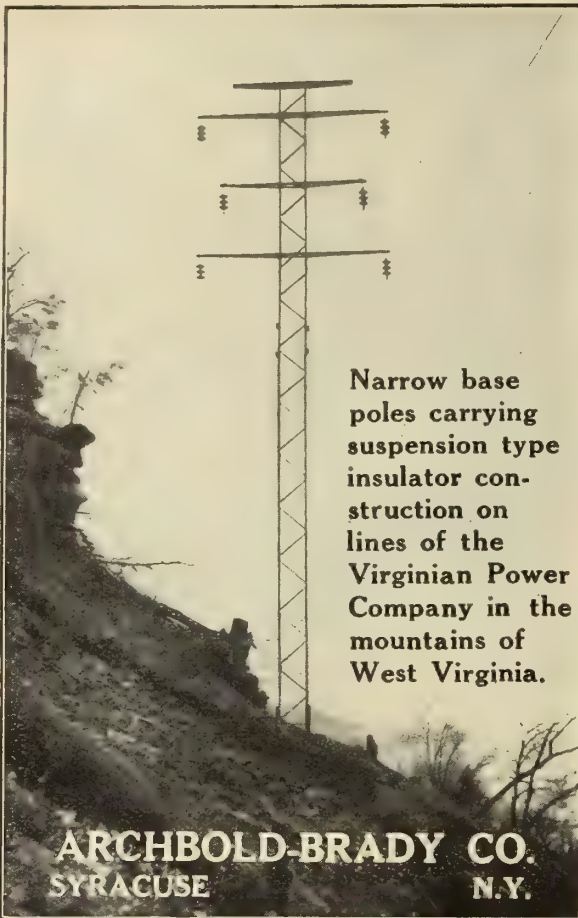
Winnipeg

Calgary

Edmonton

Vancouver





Narrow base poles carrying suspension type insulator construction on lines of the Virginian Power Company in the mountains of West Virginia.

**ARCHBOLD-BRADY CO.**  
SYRACUSE N.Y.

## "Knight" Fixtures

Prices Right

Finish Guaranteed

Fixture Parts—Chain—Loops  
—Pans—Castings, etc., carried in stock at all times for immediate shipment.

*We want YOUR next order.*

THIS SEAL ON  
ELECTRIC  
FIXTURES  
STANDS FOR  
QUALITY—  
LOOK FOR IT.



DROP A CARD  
AND OUR  
TRAVELLER  
WILL CALL,  
GLADLY.

**H. W. Knight & Bro.**  
TORONTO 86 Richmond St. E.

## Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

**Contract Record**  
and Engineering Review  
Toronto Ontario

## BASTIAN HEATERS

(ENGLISH PATENTS)



The Electric Heater that HEATS.

### NEW FALL FEATURES:

- 1.—Rodolite Glowers—increased capacity.
- 2.—Mantel Type Bastians for fireplaces.
- 3.—Flush Type Bastians for recesses.

Be ready NOW to DEMONSTRATE BASTIAN HEATERS.  
They Sell Fast.

**THE MASCO COMPANY**

Distributors

LIMITED

58-60 Church St., Toronto

"Jobbers of Standard Electrical Goods"





## Profitable Instruments

For the Dealer

Here's a line of Interior Telephones and Electric Reset Annunciators that give great satisfaction to users. We have specialized in this class of work for twenty years and can offer dealers an exceptionally good proposition.

**CONNECTICUT**

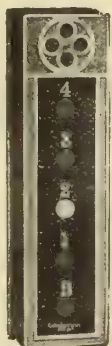
## Electric Reset Annunciators

stand for superior quality and reasonable price. They are made to give lasting service and do not get out of order. They have many advantages not possessed by other makes.

Write for catalog 22C and special agency proposition.

Handle this line in your city

**Connecticut Telephone & Electric Company, Inc.**  
Meriden, Conn., U. S. A



## Let Us Send You This New Bulletin

It is filled with valuable information for the buyer and user of cable terminals. There are tables of dimensions, weights, voltages, etc., that should be in your files. Note carefully the following:



### Table of Contents

General Description of D. S. Terminals.  
Regular Types of D. S. Terminals.  
Inner Seal Terminals.  
Wiped Joints vs. Clamped Joints.  
Separation and Insulation of Conductors.  
Insulating Compounds.  
Terminals for Ordinary Service.  
Terminals for Special Service.  
Instructions for Ordering and installing.

*A card to our nearest office will bring your copy of this book. Write now.*

**Standard Underground Cable Co. of Canada, Limited**  
Hamilton, Ont.

Montreal, Que.  
Boston, Mass.

Winnipeg, Man.  
Seattle, Wash.

Manufacturers of Electric Wires and Cables of all kinds, for all purposes, also Cable Accessories.

# "UNILETS"

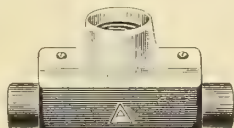
are drawn from steel and possess many merits which are an absolute necessity for up-to-date conduit work. For durability, neatness, space for making wire connections, "Unilets" meet all requirements: "UNILETS" are mechanically right. The conduit is steel, why not the fitting? Try them on your next job. A copy of our new catalogue should be before you. You cannot afford to be without it. Write us at once for your copy.



Cat. No. 9001—Rectangular Unilet.



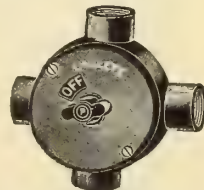
Cat. No. 9002—Rectangular Unilet.



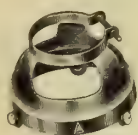
Type No. 2—Rectangular Unilet. Cat. No. 9002 with No. 7650 Receptacle.



Type No. 1 Octagon Unilet. Cat. No. 7501.



Type No. 4—Round Unilet with enclosed Snap Switch.



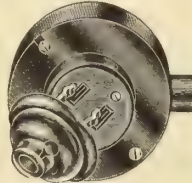
Cat. No. 7322—Shade Holder



Cat. No. 6906 Vapor-Proof Unilet.



Combination Plug Receptacle and Push Button Switch Unilet—Hubbell Plug Receptacle and Arrow E Push Button Switch Attached.



Type No. 1—4-inch Round Unilet with Two-phase Receptacle Attached.



Type No. 2—Switch Unilet. Cat. No. 6501. with Push Button Switch Attached.

ADDRESS DEPT. "D" FOR COPY OF CATALOGUE No. 7

**APPLETON ELECTRIC COMPANY**

Main Office and Factory CHICAGO 212-214 N. Jefferson Street

For Sale in Canada by

The Mainer Electric Co., Ltd., Winnipeg

Marshall-Wells Co., Ltd., Winnipeg

Chapman & Walker Ltd., Toronto



# CASTINGS FOR ELECTRICAL WORK

We make Malleable Iron  
Grey Iron  
Aluminum  
Brass

## CASTINGS

Japanned or Galvanized

**GALT MALLEABLE IRON COMPANY, LIMITED**

Galt, Ontario

We specialize in this class of work.

### Here It Is RAPID TOAST-STOVE

TO RETAIL AT \$2.50



Can you beat it at the price?

Immediate Shipment. Standard Package 25.

Liberal Discounts.

Complete with Hubbell Attachment Plug.

**R. E. T. PRINGLE**

901 New Birks Bldg. 308 Tyrell Bldg. 150 Princess St.  
MONTREAL TORONTO WINNIPEG

## Electrical Decorations For Rent

WE make a specialty of High-Class Decorations for Street Fairs, Carnivals, Celebrations, Centennials, Old Home Weeks, Street Conventions, Conclaves, Parks, Buildings, Auto Shows, Balls, Fairs, Dances, Banquets, Industrial Expositions, Food Shows, Christmas and New Years, etc.

Our decorations are elaborate, appropriate and refined. We carry a complete line of Electrical Set Pieces, Signs, Streamers of Lights and Bunting for all Lodges, Orders and all occasions. Get our prices and designs.

Contractors and Dealers are requested to get in touch with us.

**Electrical Decorative and  
Equipment Company**

70 Lombard Street, Toronto, Ont.  
Long distance phone Main 3634



Why not sell more day current?

### Simplex Electric Household Ranges

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# Ornamental Units for Street Lighting

## Luminous Arc and Novalux—Mazda

The **Novalux Ornamental Unit** has just been added to the line of C. G. E. Ornamental Street Lighting fixtures.

These units are designed for ornamental or "White Way" street lighting.

They are made for both series and multiple operation and will accommodate the 400 and 600 c. p.—6.6 ampere and the 600 and 1000 c. p., 20 ampere sizes of series mazda lamps and the 500, 750 and 1000 watt multiple mazda lamps.

The individual compensator mounted inside the ornamental casing of the series unit permits the use of the 20 ampere mazda lamps on 6.6 or 7.5 ampere circuits. As the efficiency of this high current lamp is much better than the straight series, about 25 per cent. energy is saved. This allows the Series Novalux Ornamental Units to be connected in existing circuits and permits an additional number of lights to be used without adding to the station equipment.

The **Ornamental Luminous Arc** which has met with such phenomenal success is so well known that little need be said regarding it.

We shall be glad to furnish information as to which unit will best meet the needs of your city.

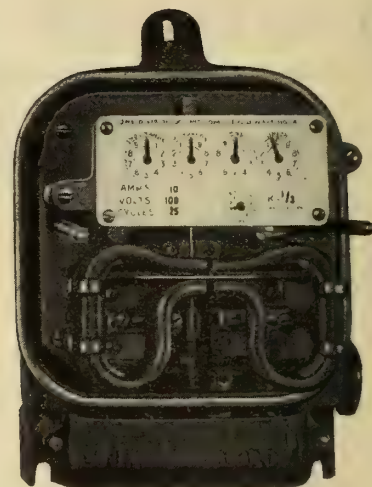
# CANADIAN GENERAL ELECTRIC CO. LIMITED

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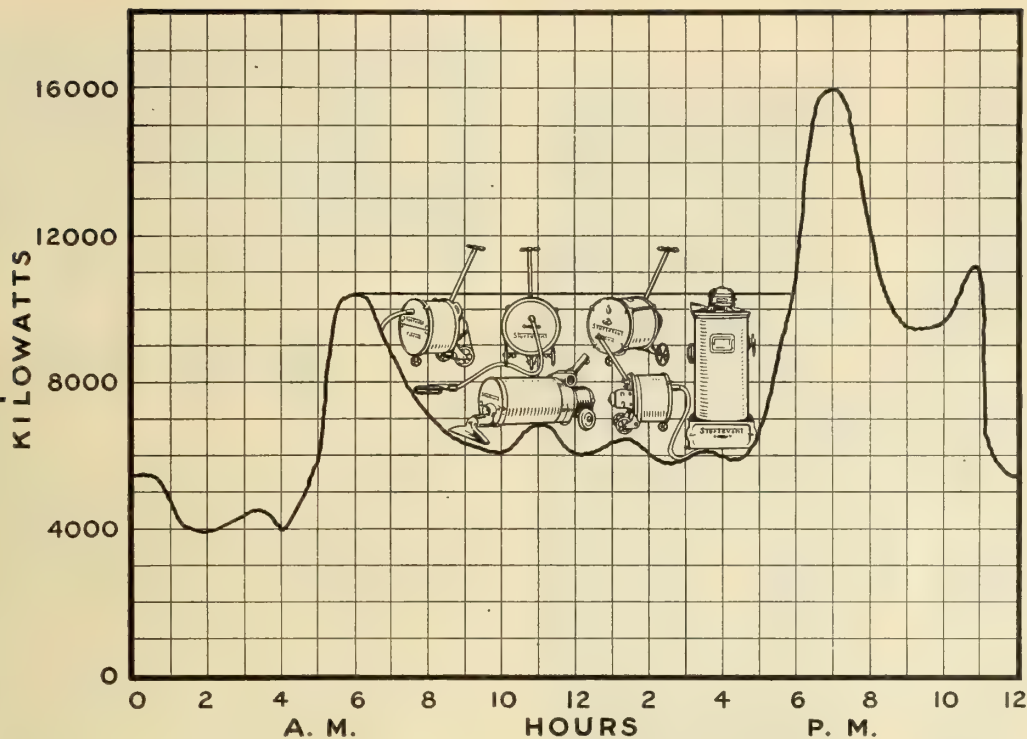
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## Fill up the Valley with Vacuum Cleaners

Your day load can be materially increased by selling your customers Electric Vacuum Cleaners. They are used almost entirely at hours of very light load. They will help fill the valley.

### Sturtevant Electric Vacuum Cleaners

(REG. CAN. PAT. OFF.)

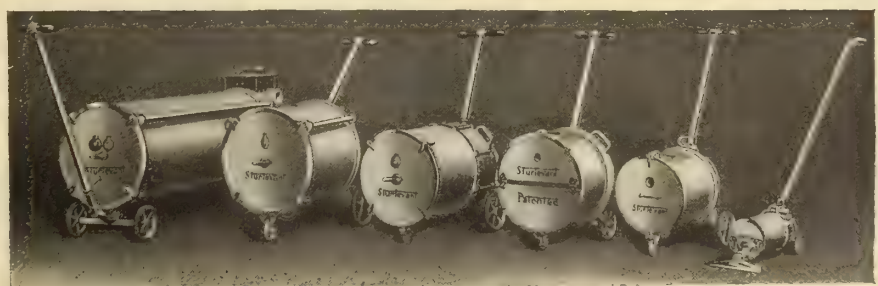
are a line you will be proud to handle. They are mechanically correct and have no complicated parts to get out of order. STURTEVANT Cleaners stay sold and each sale is a satisfied customer. These same cleaners are sold very extensively in United States under the name of the Western-Electric-Sturtevant Vacuum Cleaners and are advertised in many of the national magazines widely distributed in Canada.

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## Reduced To \$39.50

The same efficient Eureka Vacuum Cleaner is now being sold for \$5.50 less than in the past.

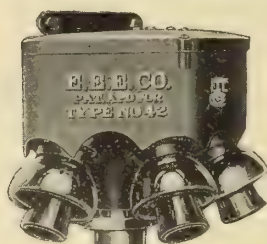
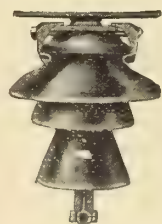
East of Winnipeg the retail price is \$39.50  
Winnipeg and the West, price is \$44.50  
Complete set of attachments \$10.00

This reduction is the result of the big increase in sales of the Eureka.

Write us for dealers' proposition.

## Onward Mfg. Co.

Berlin, Ont.



### There's a Guarantee Back of Them

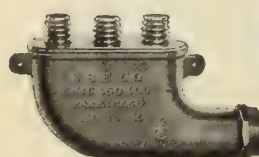
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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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Vol. 23

Toronto, September 15, 1914

No. 18

## "Fix Up" Around the Power House

An interesting communication comes from Woodstock, Ont., that "the local Hydro-Electric Commission are co-operating with the Southside Park Commission in fixing up the grounds around the Hydro power house."

This is a form of co-operation that may well be developed in many other towns in Canada. Woodstock is by no means an isolated case where the power house needs the surrounding grounds "fixed up." Indeed, our recollection is that the Hydro Commission in Woodstock have paid more than usual attention to the attractiveness of their property, both as regards the buildings and their surroundings. We wish the same could be said of other municipalities. As we pointed out in a previous article, there is very great need for an improvement in the architectural design of our power buildings and sub-stations, and it follows quite naturally that a proper care of the grounds surrounding these buildings is as important as the architectural design of the buildings themselves. This fact does not appear to be universally recognized, or, if recognized, is ignored often for many years after a plant has been in operation. It is no unusual thing to see an expensive power house or sub-station building, boasting more or less of an artistic and pleasing exterior, surrounded by piles of excavated earth overgrown with thistles and weeds and rendered still further unbeautiful by the remnants of various kinds of building material, which have been left lying around, or leaning against the new building. Woodstock is fortunate, first, in that they have a park commission who are interested in rendering the city attractive, and still more for-

tunate in that they have a hydro-electric commission who are appreciative of the value of this work. Electricity in its every application is so fully recognized as tending to elevate and educate the general public, that it is surely a great pity that the building from which this electric energy is sent out should be one of the greatest eyesores in the whole community. We trust that Woodstock's example will be noted by many other municipalities, and that gradually these power houses will be made the centres of the beauty as well as of the power of the municipality.

## For the Good of the Service

A Canadian company well-known for its aggressive tactics and efficient service, make a very strong bid for the citizens' patronage by publishing a list of a large number of Canadian and foreign associations and societies in which this company is represented by membership. It is claimed that through attending the meetings of these associations, acting as officials of some of them, reading and studying their papers and taking part in their discussions, and by constant study of the different technical and commercial periodicals and other literature devoted to the electrical and allied arts, the members of this company's staff keep abreast of the developments of the times and acquire knowledge that enables the company to serve the public as it should be served.

We believe the point is excellently taken and that the policy of this company might well be followed to a much greater extent than is the case at the present time by many other companies in Canada. The rapid advances in methods of design, installation and service have been so great during the last five years that no company which has not kept in close touch with these advances can claim to be giving a modern or entirely satisfactory service. The list of the associations, which we are publishing below, is of course unnecessarily large for the average central station, but it just indicates the determination of this particular company to have everything that is worth having. No doubt a list of periodicals studied by this company's officers and employees would be equally complete. A list of the associations and societies follows: Canadian Electrical Association, Canadian Society of Civil Engineers, Engineers' Club of Toronto, Central Railway and Engineering Club of Canada, Institution of Electrical Engineers, Great Britain, Verein Deutsche Elektrotechniker, Gesellschaft Ehemaliger Polytechniker, Zurich, Reichsverein der Oesterreichischen Privatbeamten, American Institute of Electrical Engineers (Fellow), American Society of Mechanical Engineers (Member), National Electric Light Association, United States, American Electric Railway Association, Engineers' Club, New York, New York Railroad Club, Electric Vehicle Association of America, Illuminating Engineering Society, United States, Society for Electrical Development, Sons of Jove.

## The Lowest Canadian Rates

The Hydro-Electric Power Commission of Ontario have authorized the following rates in Galt:—

Domestic rate: a floor area charge of 3 cents per 100 sq. ft. with a minimum of 1,000 sq. ft. and a maximum of 3,000 sq. ft.; discount of 10 per cent. for prompt payment. To this is added a meter rate of 2½ cents per kw.h. with 10 per cent. discount.

Commercial rate: 6 cents per kw.h. for the first 30 hours use of connected load; 2½ cents per kw.h. for all additional consumption, with a minimum charge of 50 cents; 10 per cent. discount for prompt payment.

These new rates for Galt are probably as low as, if not a shade lower than, the rates given by any other Hydro town.



With the 10 per cent. discount, the net rate is 2.7 cents per 100 sq. ft. of floor space, and 2.25 cents per kw.h. The only rates which may be said to compete with Galt are those given in St. Thomas and Ottawa, where the net rate is 3.2 cents per 100 sq. ft. of floor space and 2 cents per kw.h. Which of these rates would work out the better would depend on the area charge. Other towns in the running are Port Arthur, with net rates of 3.6 and 2.25 respectively; London, with 3 and 2.25; and Preston, with 3.2 and 3.2. It is worthy of notice that the commission at last finds itself able to break through the 4 cent flat rate, which has been maintained so uniformly up to the present time. Galt is, we understand, the only Hydro town which, as yet, charges less than 4 cents gross per 100 sq. ft. of floor space.

### Ten Good Reasons for Using "The Electric"

The Electric Vehicle Association of America has prepared a very attractive three-colored four-page inexpensive pamphlet, pointing out the value of the electric passenger vehicle for business and pleasure. The text, which has been made terse and informative, is herewith indicated:—

**Speed:** More than you can use in the city—all you'll ever require in the country—the Electric is as adaptable in its range of speed as any other type of car.

**Power:** Real hill-climbing ability. The electric vehicle will travel 50, 75, 100 or more miles per charge according to battery equipment.

**Charging:** Press a button—the rest is largely automatic. Simplicity itself and absolutely clean. Batteries can be charged with large amount of current in a short time or a small amount in a longer time (over night when not in use). For instance, if touring, batteries can be charged while you are at luncheon.

**Garaging:** At home? Yes! And simple and clean. At public garages (look for official garage and charging stations signs of the Electric Vehicle Association) excellent and inexpensive service may readily be obtained.

**Economy:** Mile for mile, all things considered, the electric vehicle is the cheapest car to run. Its low operating costs will be a pleasant surprise for you.

**Tires:** The electric vehicle is easy on the roads—therefore easy on tires. Its tire costs are comparatively insignificant.

**Reliability:** You will depend on the electric vehicle for it is worthy of your confidence—it will not fail you.

**Distinction:** The character of the electric vehicle is an expression of good taste.

**Usage:** The electric passenger vehicle is primarily a business car as used by doctors, salesmen, merchants, etc., but its ease of control; freedom from dirt and noise; smooth, easy riding qualities and reliability, have made it a great favorite with milady for shopping, visiting and touring.

**Resume:** The principles of electric vehicle design are founded on those developed in the electric railway; and their reliability and simplicity are on a par with the street, elevated and subway cars on which we so greatly depend.

The last page is arranged for an attractive imprint of the concern circularizing same.

### Electricity at the Canadian National

As usual the electrical exhibit at the Canadian National is one of its most attractive features. Unfortunately, provision has not yet been made for housing all the electrical equipment in an "Electric Building," but as far as possible the electrical machinery has all been grouped together so that the visitor can form a fairly comprehensive idea of the magnitude of this industry. The most startling advance of the year has been, of course, the introduction of the nitrogen-

filled lamp, which very few of the visitors outside of our larger cities and towns have seen before attending this display. For the rest, the exhibits show advances in refinements of manufacture and better consumption efficiency rather than in the introduction of new equipment. It is very noticeable too that the average visitor has become accustomed to electrical equipments and shows by his intelligent questions and remarks that he appreciates more fully their convenience and usefulness. This is the gratifying result of the educational campaign that has been carried on all over the Dominion during the last two or three years, with a view to showing what the possibilities of household electrical equipment are. That the exhibits at the Canadian National Exhibition have played a large part in this campaign of education there is no reason to doubt.

There is little sign, if any, that the unsettled financial and industrial conditions caused by the great European war have had any depressing effect on the Exhibition proceedings. In the electrical industry the exhibits are quite up to standard both in number, size and quality. We mention a few of the more important below, with a very brief comment on each.

**Jefferson Glass Company**—This is a Toronto firm, manufacturing lighting glassware of all kinds. Their very attractive exhibit indicated the various ways in which their Moonstone ware may be utilized for effective illumination.

**Northern Electric Company, Limited**, exhibited all kinds of electrical supplies, including telephones, heating appliances, electric wire and cables, vacuum cleaners, etc. This exhibit was very artistically arranged and was one of the most attractive to be seen at the exhibition.

**National Electric Heating Company**—A Toronto firm, manufacturing electric heating appliances. The exhibits included irons, toasters, heaters, disc stoves, and the attractive new range recently placed on the market. Household cooking utensils of all kinds were also shown, the range of this company's manufacture being very complete.

**Renfrew Electric Manufacturing Company, Limited**—This company manufactures in Renfrew, Ontario, a complete line of the smaller electrical appliances. Their exhibit was particularly given over to the display of a wide range of all kinds of electrical heating appliances, including irons, hot plates, disc stoves, toasters, coffee percolators, ranges, heaters, etc.

**British Aluminium Company, Toronto**—This exhibit was designed to emphasize the various electrical applications of aluminium. Samples of aluminium cable of all the usual sizes were shown, some of these attached to insulators to demonstrate methods of tying on and clamping. Methods were also shown of splicing and jointing. One or two specimens of lead-covered paper insulated aluminium cables for underground use were also shown. Not the least interesting part of this exhibit was a group of series field coils wound with oxidized aluminium wire without insulation.

**R. A. Lister & Company, Toronto**—This company is best known for their automatic electric lighting sets, a very large number of which have been installed at various points in Ontario. They are especially suitable for hotels, hospitals, country homes or villages, and consist of an engine, a generator, switchboard and set of storage batteries. Where gas is desired to be used and is not available, producer equipment is also supplied, though gasoline engines are quite satisfactory. Their exhibit showed one of these sets in operation.

The Canadian Independent Telephone Company Toronto, had as usual a very attractive exhibit of telephones and supplementary supplies. The exhibit included the Prestophone, a type of intercommunicating instrument specialized in by this company.

**W. H. Banfield & Sons**, manufacturers of fixture parts and fittings, Toronto, displayed a variety of their many



types of chain; also fixture parts in different stages of manufacture.

Tallman Brass & Metal Company, Hamilton—This company had an exceptionally artistic display of many handsome designs of electric fixtures, including showers, clusters, pendants, chandeliers, etc. This firm has made wonderful progress in this line, which was inaugurated only a little over a year ago. Their display was exceedingly attractive and complete.

Tuec Vacuum Cleaners—demonstrated by Mr. J. J. Martindale, Toronto, the Canadian agent. This cleaner is of the stationary type, and is adapted for large residences and public buildings of every kind. The Tuec was shown in operation.

The Jones & Moore Electric Company as usual were featuring Century motors in many different sizes. Another feature exhibited by this company was the Pelouze line of heating appliances of various sorts.

The Toronto Electric Light Company displayed a number of economical and up-to-date pieces of electrical apparatus in operation.

The Toronto Hydro-Electric System showed various household electrical appliances operated.

The Stromberg-Carlson Telephone Manufacturing Company showed their usual interesting exhibit of telephones and supplies.

The Norton Telephone Company displayed a complete line of intercommunicating telephones and supplies.

Lintz-Porter Company—An electrical contracting firm with Toronto offices. Their display consisted of a very interesting exhibit of intercommunicating telephones and electric signal systems.

The James Morrison Brass Manufacturing Company had an exhibit which created a great deal of interest in its variety and tasteful designs of electric lighting fixtures, particularly for household use.

The Crown Electrical Manufacturing Company, Brantford, exhibited a complete line of electric lighting fixtures.

The Ontario Art Brass Company, Toronto, had a very complete display of electric lighting fixtures.

The Radiant Electric Manufacturing Company, Grimsby, had their usual complete line of electric heating and cooking appliances.

The Canadian Hotpoint Electric Heating Company—Electric heating and cooking appliances.

E. W. F. Salisbury—Electric fixtures and shades.

The Consolidated Electric Company—An exhibit of considerable interest with "King Edward" motors as the chief attraction.

Cummer-Dowswell, Limited—Electric washing machines.

## The Patent Situation

We have received the following communications regarding the present patent situation, which is important in view of many misconceptions which have arisen since the war began. As more is known of this situation abroad, we shall keep our readers advised.

Editor Electrical News,  
Toronto

Dear Sir:

The present war has naturally materially interfered with patent practice on the European continent, and some time yet must elapse before points in doubt can be settled. We are, however, just in receipt of information from abroad of much importance to Canadian inventors or owners of continental patents.

France has suspended indefinitely the requirement for the payment of taxes on French patents so that all patents will

remain valid until a future date, which will be set by special decree, on which all arrears of taxes must be paid.

The German office has provided a general extension of time for three months from the first of August last for the filing of amendments to pending applications. This appears like a sublime confidence on the part of Germans in a short and successful campaign. Canadians having patent applications pending in Germany will not suffer, for the present at least, by the inability of their attorneys to do business in Germany, and if the war continues further relief may be given.

The stories of the confiscation of British patents held by Germans and Austrians seem to be untrue. We have no official advices to that effect. It is not a probable course of action, as a government has the right to use any patented inventions it may need and also the right to set the compensation, but as the citizens of a country with which we are at war have no legal status in our courts, infringement would necessarily go unpunished.

It will still be possible to do business with any European country with which we are not at war, but communication with such countries may be subject at times to delay.

Yours truly,

Ridout & Maybee.

Toronto, Sept. 3.

Editor, Electrical News:

Dear Sir:—Since writing you our letter of September 3rd in regard to patents, we are in receipt of further advices from Great Britain.

Patents and trade marks granted to a subject of any state with which Great Britain is at war are not declared to be void, but may be voided or suspended in whole or in part on application to the Board of Trade. The applicant must put up a fee of two pounds with the application, and a fee of half a crown for depositing foreign documents or other papers for purposes of record. The Board of Trade may then suspend or void the patent in whole or in part if it appears that the person applying intends to manufacture the invention and if it appears to be in the general interest of the country or a section of the community or of a trade that such article should be manufactured or any process carried on. The Board of Trade may at any time in their discretion order the voidance or suspension in whole or in part of any patent as they may see fit without special application being made to them. It remains to be seen to what extent these provisions are taken advantage of.

Yours truly,

Ridout & Maybee.

Toronto, Sept. 10

## Lightning Arresters

Editor Electrical News,  
Toronto

Dear Sir:

I enclose a short article in reply to the article published on Aluminium Cell Arresters in the "Electrical News" of August 15th. I would esteem it a favor if you could see your way clear to publish same, as, although I do not wish to comment on the aluminium cell arrester, I think the opinions, conclusions, etc., coincide remarkably with those given by the Moscicki Company, some five or six years ago, and which statements were then received more or less doubtfully.

Yours faithfully,

N. W. Lofvengren.

## MR. LOFVENGREN'S VIEWPOINT

In a recent article on Aluminum Cell Arresters, published in the "Electrical News" of August 15, 1914, page 44, opin-



ions were given by possibly the most eminent engineers on the subject on this continent (Messrs. Steinmetz, Creighton, etc.).

Whilst not commenting in any way as regards their conclusions on the merits of the Aluminum Cell Arresters, the writer would point out a few remarks, conclusions, etc., the results of the very latest practice and recent experiments, which coincide remarkably with statements published by The Moscicki Company over five years ago.

#### Frequency and Shape of Surge (Steep Wave Fronts)

Mr. Creighton says: "It has been possible to say that if future investigations of cloud lightning prove that every lightning stroke is of high frequency and steep wave front, certain changes would come about under these conditions.

. . . . The natural growth of protection would be along the line of various types of high frequency absorbers. . . . Recent investigations of lightning phenomena have confirmed our views that cloud lightning has wave fronts of various degrees of steepness. . . . That the frequency might be from zero to 5,000,000 cycles per second."

Mr. Peek says: ". . . . High energy lightning discharges of moderately steep wave fronts or moderate frequency. This is often the only condition. . . . There are certain conditions, generally in the minority, which occasionally on a few systems are the prevailing ones, which no arrester with a gap can, unaided, satisfactorily take care of. These conditions are:

1. Lightning impulses of exceedingly steep wave front and high voltages.
2. Impressed high frequency of a voltage insufficient to discharge the gap."

Mr. Mailloux says: ". . . . It would seem, therefore, as if one might expect that the character of the wave-front would depend somewhat upon the distance from the apparatus at which the lightning strikes the line. One might expect that the lightning striking the line very close to the lightning arresters would produce a current-wave having a squarer straighter front, a more vertical one, than if it struck at some distance, owing to the difference in line reactance."

Mr. Steinmetz says: ". . . . Any disturbance of a voltage less than that which will jump the gap and thus reach the aluminum cells naturally cannot be absorbed by the aluminum cells. Therefore, if we have a high-frequency oscillation of a voltage sufficiently low not to jump the spark gap and incidentally sufficiently not to do any damage to the line, such a voltage may not be able to do harm to the insulation from line to ground, but when massing of the surge occurs in a few turns of reactance such as a single coil of a transformer, it may do very great damage because, while the apparatus is designed to stand the line voltage, it is not designed to stand half the line voltage across say one-hundredth or one-thirtieth of the circuit. The main trouble, due to high frequency, comes from the local massing of voltage across the reactance. In speaking of high frequency, we may refer to various different effects, and we also usually mean a thing which is not high frequency at all, is not even oscillation—it is steep wave front. A steep wave front, to some extent, causes the same trouble, namely the same massing of voltage, but in other respects it is very different."

The above opinions can be taken as reasonably conclusive proof that the danger from "lightning," or as we would prefer to say from "atmospheric disturbances of an external nature," is due to high frequency or steep wave fronts, and we would point out that in the publications on the Moscicki apparatus, this point is particularly emphasized. On page 19 of the 1910 publication the following statement appears:—"This leads us to the important conclusion that high frequency surges of 2,000 or 3,000 volts are able to

perforate a transformer designed for 50,000." There is further given a mathematical proof that the amount or length of winding affected is not serious in the case of low or medium frequencies, but becomes very dangerous in the case of high frequencies, and also show the comparative values of a bye path (a so-called lightning arrester) with the system itself and prove the impossibility of an effective bye path based on a resistance principle, since if one makes the path so low in resistance as to be effective in protection, one permits a condition to exist that may possibly create the surges we wish to avoid.

#### The Principle of a Protective Apparatus

Mr. Steinmetz says: ". . . . Electrostatic capacity is not a lightning protective device—is not by itself a protection. . . . The favourable action the condenser can have is apparently to short-circuit disturbances of relatively high frequency. . . . The value of capacity in protective devices lies in the fact that it is a barrier against the passage of current at machine frequency without being a barrier to the passage of surge currents which are inherently of high frequency."

Mr. Peek says: "The dielectric breakdown time lag of the gap may prevent discharge of the arrester before discharge takes place at some weak point in the system. The discharge does not take place at the gap because the voltage is not high enough, but the oscillations may build up high voltages internally in an apparatus containing inductance and capacity."

All the publications on Moscicki condensers clearly demonstrate the danger to windings due to "the massing of voltage between turns" on the occasion of a high-frequency oscillation. They further show mathematically the value of a condenser between the terminals of the transformer or machine and earth, thus "short circuiting" disturbances of relative high frequency," but not in any way affecting line current. It is not claimed that the Moscicki condenser dissipates energy, but it is claimed to so affect the shape of the high frequency surge, as to flatten it out, absolutely preventing dangerous conditions on the system, and so absorbing the shock, performing a somewhat similar function as does the gas bag to a gas engine.

#### The Operation of Electrolytic Arresters

Various remarks have been made regarding the characteristics of the aluminum cell arrester. On page 44 Mr. Creighton says: ". . . . The discharge rate at double potential is more than a million times as great as the leakage at normal potential." Though this be the case, we do not see that there is any advantage in having a leakage current at all, and the most perfect apparatus of course would have no leakage at a normal voltage and frequency.

Again, it is said: ". . . . The higher protection given by the cells would justify some increase in expense on account of the better service that can be maintained. . . . . When the number of arresters in use ran up into the thousands, then an occasional trouble resulted from the rush of current into the aluminum cells. The aluminum cells are condensers and as such will take initially a considerable rush of current. Furthermore, the dissolution of the aluminum films required a considerable quantity of electricity from the line to reform them. Where the films had been subjected to unusual dissolutions, either by standing in hot electrolyte, resulting from atmospheric temperature or long periods of discharging, or from neglect to charge, the current rush into the aluminum cells became a serious menace, mostly to the arrester itself. Since there is no external indication of a bad condition of the aluminum cells, even an expert would be unable to know if it were permissible to close the charging gap of the arresters. This led naturally to the use of charging resistances in series during the ten



seconds a day needed to charge the arrester. The charging resistance is an added expense and an added complication . . . . bad regulation of a line in which the power voltage is allowed to rise to values above the spark potential of the arrester. Under these conditions of discharge the arrester is no longer being used as such, but rather as a rheostat to absorb the generated power. The arresters cannot at any reasonable expense be designed to act as rheostats.

. . . . Certain kinds of impurities have a strong destructive effect on the films. A condition of unusually high operating temperature may call for an electrolyte especially adapted to high temperatures, or it may simply be taken care of by charging two or more times a day. Dissolution of the film from standing in hot electrolyte after the arrester has discharged continuously for a number of minutes can cause no trouble if a reasonable charging resistance is used, as the series resistance limits the current to a value which will not damage the arrester. With the exception, then, of high generator potentials from bad regulation of voltage, there is no difficult problem connected with the use of aluminum arresters."

All these characteristics of operation, etc., certainly do not add to the advantage of the aluminum cell arrester, and though means may be evolved to overcome these various disadvantages and permit of more or less reliable operation, an apparatus such as the Moscicki condenser, in which these disadvantages do not occur, is of course to be preferred. The effect of possible trouble is not by any means advantageous to any apparatus.

#### Are Arresters Required?

Mr. Creighton, on page 51, says: ". . . . Since the factor of safety of the insulators was about 10, they were not functioning as lightning arresters or protectors for the apparatus, and consequently every lightning stroke that appeared on the line came with horrible impetus into the station. Switch bushings, transformer bushings and other insulation that had withstood the conditions of other circuits, immediately began to break down from flash-over or by puncture. Lightning arresters of the best type were then required. This is a condition that is gradually growing all over the country. Everywhere operators find that insulation on the line is an important factor, and are increasing the factor of safety in the line insulators. Personally, I would never use a factor less than three times normal potential, preferably still higher. The extra investment in insulators is worth while. This ultimately necessary practise will increase the need of lightning arresters."

And this very clearly explains the value of arresters on a system.

Seeing that the various opinions, etc., expressed above coincide so clearly with those given by the Moscicki Company, and that their apparatus has been particularly designed to meet these conditions and afford protection from the phenomena mentioned, it would seem that the Moscicki designs are more nearly a step in the right direction for the elimination of lightning troubles than the various other apparatus.

This is also borne out in practice, as, in localities where the Moscicki apparatus has been installed, in every case highly efficient service has been rendered, and the protection obtained far superior to that of any other scheme, there being no leakage current under normal conditions, no periodical forming, and therefore no possibilities of danger from the human element.

The engineering staff of the Montreal Harbor Board is engaged on plans for an electrical railway to replace the present steam line which runs along the harbor front. It will be an elevated line. Construction work will not be commenced until next season.

## Opportunities for Sales Engineers

By S. L. Nicholson\*

Various classes of engineering services are required by a large electric manufacturing company. The research engineer delves into compositions of materials and theoretical considerations and must be of an analytical turn of mind. The designing engineer must be able to design apparatus and supplies to meet certain definite requirements at a minimum cost; that is, he must be able to design apparatus which can be sold at the regular market price and at a profit for the company. Engineers are also required for testing and supervising the erection of apparatus.

Just now a comparatively new type of engineering presents great opportunities; viz., application engineering salesmanship. The field of activity is almost unlimited, as it has to do with the application and uses of electricity in connection with practically all the ramifications of industry. The application engineering salesman should have a knowledge of both electrical and mechanical engineering; he must understand what results are obtainable. He must be proficient in sales work from the standpoint of understanding commercial conditions. He must be responsible (considering one phase of the work) for the electrical development and laying out of power houses, transmission lines and railway work. He must be able to co-operate with the other engineers in making up plans and estimates of specific layouts and he must also be sufficiently commercial to interest bankers in his new projects. In another type of application engineering the engineer is responsible for the development of an industry, and in this case he must be also a process engineer; he must understand factory methods and be able to propose improvements by the use of electric power; he must be able to apply existing apparatus to the field conditions in such a manner as to produce a profit for the investor.

Another class of engineering is taken care of by the consulting engineer who must have a broad experience and should be an application engineer as well as somewhat of a designing engineer.

In order to apply engineering to sales work so that the relation between the two may be understood readily it will be well to outline the various classes of men engaged in an electric sales organization. The negotiation salesman is found largely in the central station or railway work. He has perhaps comparatively little knowledge of pure engineering theory (his plans can be worked up in detail by the application or designing engineer), but he must be of the promoter type, that is, he should be able to see opportunities for development in water-power sites, etc. Bearing in mind the community needs, he should be able to interest the bankers so that the undertaking can be properly financed, and he must be able to translate engineering terms into the language which non-technical men can understand. The old method of selling, via the stomach, has given away to service selling, by the promoting engineer.

The electrical engineering salesman who is found in the railway, lighting and supply departments, must know the design of his apparatus in such a way as to be able to present to the customer the best arrangement of apparatus to suit his needs.

The application salesman is found principally in industrial and power work, and to a lesser degree in the illumination and railway fields.

The merchandising salesman has to do almost entirely with the merchandising of commodities through dealers, jobbers, etc. He must be familiar with price situations and methods of distribution and must be able to create a demand

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for his product. His work consists largely in creative salesmanship.

It will perhaps be advisable to outline some of the functions of the sales department. First, is the laying out of new central station plants and railway systems, which is a function of negotiation and electrical engineering salesman. Consideration must be given to the capacity of stations, the size of generators, the requirements of transmission lines, and the conditions in railway service. This work requires a great deal of co-operation with consulting engineers. Next, is the revamping of old plants, in which the application engineer studies how to use the latest devices to increase output or to economize in operation so as to increase earning capacity. He must make friends and be able to create confidence by getting into close touch with the customer.

The application of motors to various industries requires a high type of engineering and provides a wide field of opportunity. Motors are sold for complete plants to increase output, to reduce cost or to better the product. To determine how to do these things is the study of the application engineering salesman. There must also be an outlet for apparatus through the re-sale trade, such as to machine-tool builders, and the manufacturers of centrifugal pumps, elevators, etc., who purchase motors to be sold again. Since these buyers are mechanical rather than electrical engineers, the salesman must be both an electrical and mechanical engineer. Ten years ago the tool builders fought electric drive. Electrical salesmen showed that by strengthening the tool rest of an 18-inch lathe and applying an adjustable speed motor, the lathe could be sold for a higher price by basing the guarantees on the amount of metal that could be cut in a given time. The wide range of speed control of electric motors became an important factor in enabling efficient use of high speed tool steel to be made. It became necessary to study torque conditions in order to determine the proper motor to apply. For example, in raising the head of a boring mill, where formerly a two horse-power motor was used, a three-quarter horse-power motor is now furnished and 300 per cent. full-load torque is required for short intervals of operation. The activity of these men in applying electrical equipment to complete plants and to the re-sale trade results in increasing the central station loads.

The services of a few electrical engineering salesmen are required in the sale of transformers, regulators, reactance coils, meters, etc., to central stations. Switchboard engineers, located in the larger sales offices, design switchboards for specific cases out in the field and send the specifications to the factory. Other salesmen study conditions for the application of heating devices for various industrial purposes.

The necessary qualifications of an application engineering salesman may be briefly indicated. He must be able to analyze conditions carefully from an engineering and economic standpoint and draw conclusions therefrom. In connection with the activities of the present application salesmen, more mistakes are made on the mechanical side than on the electrical side. In applying motors it is necessary to decide whether they should be connected by belt, gear or chain to the device which they are to run, to determine the number of bearings needed, etc. The salesman must be able to analyze and draw conclusions so as to be able to present his case to the designing engineer in a clear concise manner, including details, so that the engineer will not have to go back for further information. He must also be able to present his case in a way that will be understood by the customer. He must not tell the textile man that his motor has high torque, but rather that it will throw the shuttle clear across at the first crack. In other words, he must translate electrical engineering jargon into ordinary textile mill English. He must have what the large majority of men lack, initiative. He must be able to see openings for electric mo-

tors in new fields and analyze them. For example, he must analyze a cement mill to find out whether electric motors can be installed, and how, together with all the details, and be able to determine whether the output can be increased, quality bettered and cost reduced; and must then find ways and means of getting the message to Garcia.

There are certain fundamental essentials for every salesman. He must be very enthusiastic and never discouraged. He must have confidence in himself, in his product, and in his Company. Some salesmen who think they know it all have proven weak-kneed when they strike a difficulty. The salesman must know how to present himself and his product. He must know how to get the signature at the psychological moment.

I have observed numerous college graduates and find that a great many of them are not very much good at first. The student should be awakened to an interest in his subject, and should also become interested in doing something outside of the class room which requires individual initiative. For example, he should be required to write a report on what is being done with respect to the application of motors to certain industries in the neighboring territory. The student should obtain a good foundation in fundamentals and be a good mathematician. Most students are being trained for the purpose of making a living. They should be shown how a certain formula is useful, for example, in building this or that kind of a bridge, thus awakening practical interest. They should use a slide rule. A man should go to college to get the right brain kinks, to think rightly and to reap the benefit of mixing with his fellowmen, as well as to acquire knowledge. The student should develop a keen sense of analysis and know how to express himself on his feet and to say what he thinks. He should be made to understand that, unless he can improve conditions, his work will be for naught. To improve industrial methods or conditions should be his mission in life.

To know how to think gives the right results in the long run. Of two boys, start one to college and one to work. The latter will get better pay at 22 years of age and can get results. He has mixed with laboring men but he does not know society nor how to present himself to a president or manager. At 35 the shop man has usually reached his limit; the other man passes him because he knows how to think.

College professors should study the various fields in which mechanical and electrical engineers should be located, so that they can give proper advice to their students. They should get outside men to come to the college and discuss the fields of the future. Instead of merely hearing the boys recite they should get into human relations with them. Psychologists should sort the freshmen on coming to school. The teachers should then get at the souls of the students and attempt to build men rather than to cram brains. I have a great admiration for teachers, as there is no calling so great as that of building men.

#### An Important Resolution

At the recent Detroit convention of the Electrical Contractors' Association a resolution was passed to the effect that all wires larger than No. 16 should be double braided and all wires larger than No. 10 should be stranded. It was appreciated that No. 14 wire used principally in small residence wiring jobs would be affected most by the change but it was considered that the many advantages would offset the disadvantages. One very great advantage seemed to be that there will now be no necessity to manufacture both single and double braid wire so that the stock of the contractor will be reduced and he will have less capital tied up. It is said the electrical contractors at the convention were very enthusiastic in support of the motion.



# The Distribution of Electric Energy

## Latest Developments in Engineering practices in a. c. and d. c. General Distribution and for Street Lighting Only

A sub-committee recently appointed by the American Institute of Electrical Engineers have reported on the distribution of electrical energy. The chairman of the committee, Mr. P. Junkersfeld, describes the report as an outline of what is believed to be good engineering practice in the distribution of electrical energy for various purposes and under various conditions, which outline, it is hoped, will encourage and direct further attention to this vitally important matter.

Below we reproduce, in extract, sections of this report prepared by Mr. Philip Torchio, Mr. H. B. Gear, and Mr. P. M. Lincoln, the first on three-wire, direct-current distribution; the second, alternating current distribution, and the third, distribution for street lights only. Though these reports treat the subjects more or less in outline, much useful information is given in the way of foundation work which will be of great value to all distribution engineers.

### THREE-WIRE D. C. DISTRIBUTION

By Philip Torchio

The modern three-wire d.c. distributing systems consist essentially of a three-wire network of distributing mains fed by a multiplicity of cable feeders delivering current at different points of the network of mains, and a system of sub-stations supplying the current to the feeders.

With the exception of the former low-tension d.c. generating stations which have been replaced by the modern sub-stations receiving high-tension alternating current and transforming it into low-tension direct current, the complete three-wire distributing network of over 25 years ago is still giving in every respect its full 100 per cent. service alongside of all subsequent additions. This is almost a unique instance of permanency of usefulness of electrical apparatus used by central stations.

#### Feeders and Mains

The current was formerly distributed underground by Edison tube feeders, but in the last fifteen or twenty years the cable system has superseded the former tube systems. For feeders, concentric cables with pressure wires are often used, they being either armored and laid in the ground, as is done mostly abroad, or being drawn into subway ducts, as in this country. In other cases single-conductor cables are used with pressure wires in the main cables or separate pressure wires outside. The network of mains consists of three single-conductor cables, of equal copper cross-section, drawn in distributing ducts in the streets near the curb line or sometimes under the sidewalk. This system of mains is interconnected at each street crossing, thereby making a solid meshed system. Feeders, which are laid from the station to a number of suitable points, end at a junction box into which enter the feeder cable and pressure wires, and from which issue the main cables tying to the network of mains meeting at that intersection of the street. The junction box may be installed in the manhole or just outside in the street. The neutral main cables are spliced together and grounded at frequent places; in addition, there are neutral feeder cables starting from the sub-station and going to different points on the system with frequent grounds and taps to ramifications and to the neutral mains. The total amount of copper for neutral feeders is about one-twelfth of that for positive and negative feeders.

In a large system the amount of copper for feeders and mains in per cent. of the total is as follows:

Feeders positive and negative ... ..	58.9 per cent.
Feeders neutrals ... ..	4.8 per cent.
Mains positive and negative ... ..	24.2 per cent.
Mains neutrals ... ..	12.1 per cent.

#### Subway Ducts

Handholes are placed at convenient places along the distributing ducts and service connections are made to the adjoining buildings by tying service cables to the mains. These service cables are drawn in an iron or fibre pipe laid in the ground and ending in the basement or cellar of the building to be supplied.

#### Service Connections

At the customer's service the supplying company places a disconnecting switch and protective fuses and its current registering and metering devices. A type of modern service connection for lighting and power, consists of porcelain blocks, which are equipped not only with fuses and all the connections to the watt-hour meters, but also with clips, by means of which the testing of the watt-hour meters, on the customer's premises can be readily accomplished by inserting a plug with connections to the testing apparatus, thereby avoiding interference with the supply of current to the customer while the test is being made.

All of these appliances are enclosed under covers which are locked and sealed. From this point the customer derives his supply, three-wire for lighting and two-wire for power, which services are usually metered independently.

#### Standard Voltages

The usual distributing voltages used in this country are,  $2 \times 110 = 220$  to  $2 \times 120 = 240$  volts, though in a very few instances  $2 \times 220 = 440$  to  $2 \times 240 = 480$  volts are used.

If the multiple tungsten lamp eventually encroaches into the field of the arc lamp, the advantages of first cost and greater radius of the higher voltage systems would assume greater prominence than heretofore.

#### Principal Elements in a Sub-Station

In general the full double voltage is generated by the converters or the motor-generator sets at the sub-station and the neutral of the system is secured by several means, among which are storage batteries, balancer sets, derived neutral from transformers, and other means.

The leads of the positive and negative connections are brought to separate boards. The neutral connections are made not at the board, but in the basement of the sub-station or in the cable vault. Each of the two separate positive and negative d.c. boards is equipped with multiple buses, and all the feeder switches are selected to connect to any of these several buses. By this arrangement according to the load requirements different machines can be operated on different buses at different voltages, and the shorter feeders can be connected to the low-voltage busses and the longer or more heavily loaded feeders to the higher voltage busses, thus securing voltage regulation throughout the network.

Selective switches are used for converters and feeders. By means of the edgewise system, the space occupied by the d.c. switches is reduced to a minimum, so that amounts of



power as large as 30,000 kw. at 240 volts can be distributed from one sub-station.

The references give valuable material on the modern tendencies in sub-station design and equipment which cannot be treated fully in a brief review of this kind. We may mention, however, a few features of the latest developments which made possible large improvements in economy and simplicity of station. Among them stands foremost the development of the commutating-pole synchronous converter. This, in conjunction with graphite brushes with slotted commutators and self-lubricating copper graphite brushes for the collector rings, has made the operation of synchronous converters practically independent of attendance, except for the starting up and shutting down and the periodic cleaning and setting after the machines are shut down. Other important innovations have been the split-pole synchronous converter and the synchronous booster converter for obtaining regulation.

The manufacturers have produced units as large as 4,000 kw. and they are now prepared to furnish still larger units if desired. Converters are usually six-phase and have been in many cases operated with double delta connection, though from recent tests it would appear that diametrically connected converters will operate practically under the same conditions as a double delta connected machine, and still have the advantage of greater simplicity of connections between transformers and converter. The synchronous converters are usually started from the d.c. end.

Air-blast transformers have been used most extensively and the practice of one large company is to have the blower motor connected directly to the secondaries of the transformers, so as to start it when the transformer is energized.

#### Storage Batteries

The installation of storage batteries at sub-stations is a distinctive feature and great progress has been made in the last few years in the adoption of the stand-by batteries, consisting of very thin plates, similar to those used for electric vehicles. These batteries can give for a short period of time large current discharges and often are designed to give, say for ten minutes, the full output of the sub-station in case of emergency.

Material improvements have been made in the method of end cell switch controls and connections.

#### Control

In very large systems great care is given to a number of such details, like the standard voltmeters for regulating purposes; the station lighting and power supply from duplicate sources; the telephone connections to the generating stations through independent lines and public telephone exchanges; and the emergency signals controlled from the generating station, giving simultaneous instructions by code to all the sub-stations on the system.

### ALTERNATING-CURRENT DISTRIBUTION

By H. B. Gear

The distribution of alternating current will be considered to include both bulk supply and general distribution. In the larger cities where the general distribution is made from sub-stations, the bulk supply of energy is distributed by means of three-phase alternating current from the source of power to the points of distribution where it is converted to the form required for general purposes, for street lighting or for railway purposes. These lines are so numerous, and are so related to each other through tie lines, that they constitute a magnified form of distributing system with problems peculiar to themselves, which require consideration which might be lost sight of if they were classed as transmission lines.

Bulk distribution systems will be considered without

regard to whether the energy is used for alternating-current distribution, direct-current distribution, or electric railway work after its conversion.

#### Bulk Distribution

These systems are quite universally operated on the three-phase system at 25 or 60 cycles and at 6600 to 20,000 volts. The lower voltage is used where the radius does not exceed six miles and averages much less. In some systems the longer lines have been raised to 20,000 volts or more, to handle the supply to suburban districts more flexibly. In the vicinity of Berlin there is an extensive 30,000-volt cable system serving the outlying parts of the city and suburbs. The German and English cable manufacturers have apparently been very successful in the production of cable for voltages above 20,000 volts, and such transmission lines are placed underground much more generally in Europe than in America.

The choice of frequency is fixed by the relative proportion of energy converted to direct current through synchronous converters. Where the direct-current load greatly predominates, 25 cycles is used and frequency changer sets furnish the alternating-current supply at 60 cycles. Where the alternating-current supply distribution predominates the power supply is often generated at 60 cycles. In several cases both 25 and 60-cycle generating systems are maintained; reserve capacity for each being secured through frequency changers.

Bulk supply systems have been developed in America chiefly on the principle of radial lines. A radial system is built up by the use of direct lines from power station to sub-station, one such line usually being sufficient to carry the load when the sub-station is established. The reserve source of supply, which is imperative, is usually secured by a tie line from another sub-station; or, in case of a small sub-station, by tapping another direct line at a convenient point.

The transmission system of one of the large companies in America has been developed on the principle of duplicate lines arranged with sub-stations in tandem. The converting units in each sub-station are divided into two sections so that an interruption on either line interferes with only one-half of the capacity in operation. These lines are protected by overload circuit breakers actuated by definite time-limit relays, so set that they will operate in tandem; that is, only that part of the service is interrupted which is beyond the fault in the cable.

As the loads increase and require more lines, the importance of having a diversity of routes to guard against the failure of two or more cables to the same sub-station becomes apparent. Congestion near the power station must be guarded against by limiting the size of duct runs and providing several separate conduit routes.

As sub-station loads increase, the percentage of reserve investment becomes smaller, as one reserve line is sufficient for the three sub-stations.

It is usual to provide a transfer bus at sub-stations so that any line can be connected to either tie line or to any converter.

A large proportion of the lines making up bulk supply systems in large cities is placed underground in lead-sheathed three-conductor cables drawn into ducts. The most economical use of capital is made when such cables are as large as can be properly handled. The kilowatt capacity of a high-tension cable at a given voltage increases more rapidly with increasing sizes of copper, than the cost of the cable. The most economical cost per kilowatt, therefore, requires the use of as large a cable as it is practicable to draw into a standard 3½-in. duct.

The following tables give the maximum sizes of three-



core cable which are installed at the present time and their approximate continuous capacity at various voltages:

Volts	Size of each core	Ampere	Kv. a.
6,600	350,000	290	3,200
9,000	350,000	290	4,500
13,200	250,000	220	5,000
20,000	150,000	145	5,000

The current values are taken for average conditions. They are somewhat high for situations where the facilities for heat radiation are poor, or where there is a considerable number of other cables liberating heat in the same duct line. These amounts of power could also be exceeded for a few hours during a peak load, without risk of injury.

Previous to the last two or three years it was not always satisfactory to operate high-tension lines in parallel at the sub-station end, since a fault in either of the cables supplying a sub-station is likely to open the circuit breakers of cables not affected, thus shutting off the entire supply. This was due to the absence of reliable reverse-power relays which would permit the most satisfactory parallel operation.

Prior to the development of the commutating pole converter, the largest unit which was considered advisable had a capacity of 2,000 kw. These machines were designed to carry 2,500 to 3,000 kw., however, for about two hours. It therefore became common practice to have a line for each 2,000-kw. converter or for two machines where 1,000-kw. units were installed. Thus the average load per cable was about 2,000 kw. under normal operating conditions, and as the cables used had a capacity of 3,000 to 4,500 kw., there has been an accumulation of surplus cable capacity amounting to from 50 to 80 per cent. of the maximum sub-station load. This is particularly true of sub-stations having loads above 4,000 kw. The situation is such that there is, at the present time in Greater New York and Chicago, not far from \$1,000,000 worth of surplus cable investment which could have been saved if means for parallel operation of cables and larger converting units had been available prior to 1910.

The introduction of converting units of 3,000 to 4,000-kw. capacity for direct-current work and three-phase transformers of almost any desired capacity for alternating-current distribution has done much to improve this condition in recent years. These units permit the use of cables at a point near their full safe carrying capacity and make possible large savings in future cable investment.

Another source of relief has appeared in the development of protective relays designed to permit lines to be operated in parallel. The Merz-Price system has had large and successful application in the north of England in a field where its value is greatest; that of the distribution of industrial power in blocks of 200 to 1,000 kilowatts by means of a high-tension network. This system unfortunately involves the use of pilot wires which, not being included in existing cable systems, makes its introduction more expensive and difficult than a system of reverse-power relays. (An interesting modification of the Merz-Price system, in which so-called "split conductors" render unnecessary the use of pilot wires, has been developed in England; but so recently that little definite experience is available.) However, it is probably the most reliable means at present known of guarding against interruption of service by cable faults.

Modified forms of reverse-power relays have been developed within the past two years, some of which are under trial at the present time. The performance and further development of these devices will be watched with the most sympathetic interest by all who are interested in getting high-tension cable investments down to a basis of econ-

omy comparable with other reductions made in plant costs in recent years.

### Alternating-Current Sub-stations

The alternating-current sub-station, in its simplest form, consists of a set of transformers with a minimum of switching equipment and auxiliaries mounted outdoors. After the load has grown so that two or more distributing feeders are necessary, circuit breakers, potential regulators and instruments must be added if first-class service is required. These require a building, the character of which is dependent upon the location and relative importance of the sub-station.

In sub-stations of 1,000 kw. or less it is usual to find oil-cooled single-phase transformers. With larger sizes, air or water-cooled units are more economical. In three-phase systems three-phase units are often employed in sizes of about 750 kw. and upward. In two-phase systems which are operated in connection with three-phase transmission lines single-phase transformers are selected for the Scott connection.

When the power supply is generated at 25 cycles the frequency-changing motor generator becomes a factor. This usually involves synchronous motors, and introduces excitors, starting compensator and necessary accessories in the way of switchboard equipment. Motors of frequency changers are usually wound for the transmission voltage to save transformer investment where the transmission voltage is not above 15,000. Induction motors are used in some cases to secure greater stability at times of system disturbance.

The induction type regulator has largely superseded the transformer type. The superior results secured from automatically controlled regulators in the regulation of pressure has made them standard for important lighting service. The details of line drop compensators, contact-making voltmeters, and motor control have undergone a steady evolution in the right direction in recent years. The adjustment of springs and condition of contacts, however, still require periodical inspection and checking of pressure at feeder ends. In Chicago it is found necessary with some 200 sets of equipment to check each of them at least once in three months by the installation of recording voltmeters for a few days at the feeder end.

The improvements in transformer design, by which weights and costs per kilowatt of capacity have been reduced, and the increasing requirements of good service, have made some striking changes in the cost of transformer sub-stations. The transformers, which one ordinarily thinks of as the chief item, constitute less than one-third of the cost of a modern 5,000-kw. sub-station, housed in a fireproof building and equipped with the required quota of oil switches, automatic regulators, duplicate busses, instrument and control panels, etc. The automatic regulators, feeder switches and distributing buses make up about half the total cost. A large part of the facilities of a modern sub-station is necessary for the safety of operating and construction men whose duties must be performed without accident to themselves or to the service and equipment.

### General Distribution

The distribution of alternating current for general commercial purposes is accomplished in America almost universally by 2200-volt mains supplying step-down transformers located near groups of consumers whose premises are served by secondary mains at 110-220 volts. There are a few installations of low-tension alternating-current feeders on the Edison system at 110-220 volts in business districts, and some installations of 220-440-volt mains have been made where it was desired to avoid primary lines.

Lighting is quite generally served single phase; while power service is given from two-phase or three-phase mains.



Two-phase systems are in use chiefly where this method of distribution was established in the early period of development and is too extensive to warrant changing to the three-phase system. Three-phase systems are standard for all new installations where polyphase supply is desired for general power service.

Single-phase distribution is cheapest for lighting and small power mains at the load densities usually found outside of business districts, as the smallest size wire which should be used for mechanical strength is ample for ordinary loads. Three-phase, three-wire primary distribution is preferable in cities where sub-station loads do not exceed 1,000 to 2,000 kw., but four-wire distribution is most economical for larger loads and the greater distances which usually go with them in the large sizes. The four-wire system—being a 2300-4000-volt system—permits the supply of larger power users at outlying points more economically than by three-wire, 2300-volt systems.

The ability to regulate pressure independently on the different phases with greatly unbalanced loads makes possible the use of single-phase lighting distribution without sacrificing the advantage of three-phase transmission on the feeder.

The supply of power service in manufacturing districts is sometimes accomplished by the use of separate power feeders, the lighting being carried on other circuits. In other cases the light and power are combined. The use of separate power circuits tends to produce a duplicate distributing system and requires increased feeder capacity on account of the lower power factor, while with combined service the lighting tends to keep the power factor up. The diversity of demand between power and lighting loads also makes possible a considerable saving in feeder capacity where the lighting load in a given district is of the same order of magnitude as the power load.

Thus the policy of a combined feeder system is preferable from the standpoint of both feeder and main investment, in most cases.

With modern pressure regulating apparatus there are not many situations where the lighting service cannot be made what it should be, when power is served from the lighting system.

The primary main system cannot be interconnected as the mains in a low-tension system, because it is impracticable to provide fuse protection in such a way that it will isolate a section of main which is in trouble without simultaneously blowing other fuses through which the energy is supplied. Thus the primary system loses the advantage of parallel feeding, and requires that the feeder end be located as nearly as possible to the electrical center of the district which it serves. The arrangement which gives the best distribution of pressure thus naturally takes the form of a center of distribution with radial mains. These centers of distribution should be chosen so that the drop on the primary main will average about two per cent. from feeder end to transformer. This limit is not always commercially feasible in the case of lines to outlying districts where the load is not yet large enough to justify the cost of extending a feeder.

In cases where a feeder follows a main thoroughfare along which most of the load is located, and the side branches are short, the tree system sometimes is used. This tends to give high pressure at the near end and low pressure at the far end but saves the cost of a "back feed" main.

In three-phase, four-wire systems a modified form of the center of distribution plan may be used. The center of distribution of each phase is located with reference to the electrical center of the single-phase load carried by that phase. Since each phase can be regulated for pressure separately this gives a good distribution in scattered districts, and permits feeders to be loaded more heavily than is pos-

sible when the load is distributed from a single center. In the denser business districts it is possible to pick up enough load for a feeder within a small radius, and a single center is adequate.

The separated centers of distribution can be used in two-phase systems but do not work out well for three-wire, three-phase circuits, since the line drop compensators cannot be set to take care of drop in the single-phase branch after it leaves the other phases.

### Emergency Switching Points

Where portions of the primary system are underground and where mains of adjacent feeders come together it is important that suitable facilities be provided by which the mains of the two circuits may be joined together in emergencies. Cable repairs require a considerable time and if service is to be resumed promptly such emergency connections must be provided in sufficient number to permit the minimum interruption of service. Emergency switching points are also necessary as a means of putting sections of cable out of service while new cable taps are being cut in. The safety of linemen and continuity of service largely depend upon the facility with which sections of the primary main system may be controlled. Outdoor types of oil switches are used to some extent on important branches. The disconnecting type of porcelain pothead is found well adapted to this work, particularly at cable poles.

### Secondary Main Systems

The arrangement of secondary mains depends largely upon the density of the load. In outlying districts where the load runs from one to ten kilowatts in each block the size of secondary wires is comparatively small and the distances between transformers are such that the interconnection of adjacent secondary mains is not commonly desirable. The geographical arrangement of such mains tends to follow principal streets with few important mains intersecting. The failure of a transformer fuse under these conditions throws an overload on the adjacent transformers and the entire interconnected main is likely to be put out of service.

In the denser parts of a city where business buildings are served, a cross-connected network may be developed. This is less likely to cause trouble as the load of any transformer in trouble is usually divided between more than two transformers, and the danger of blowing other transformer fuses is lessened.

The secondary system may be protected against trouble originating in the transformer by the use of "network protectors." In New York City it is customary to operate the larger transformer secondaries in parallel, using such a device quite generally. The "network protector" consists of a small transformer having the same ratio as the main transformer. The primary and secondary leads of the main transformer are carried through the protector in series. In case of a defect in the transformer the fuses of the protector quickly open the connections to the network and thus prevent the current from blowing the fuses of other transformers.

The interconnection of secondary mains has the advantage of permitting the use of spare capacity, where available, to take overloads on adjacent transformers. The diversity factor between different groups of customers may thus be utilized to make a reduction of transformer investment in some cases.

Motors cannot usually be served from lighting secondaries (except in the smaller sizes) without interfering with lighting service, on account of the fluctuations of pressure caused by starting currents. Where the requirements of lighting service are high it is therefore necessary to in-



stall separate transformers for power customers having motors of five h.p. and upward. In scattered residence districts it is often necessary to put motors of one h.p. and larger on separate transformers.

In alternating-current distribution in congested business districts where a network may be developed underground with loads of 75 kw. and upward in each block, it is very desirable to be able to serve light and power from one system except, perhaps, for users requiring about 26 h.p. and upward. The problem has been met in several instances by retaining the 500-volt direct-current distribution and establishing a three-wire Edison alternating-current network for the lighting and miscellaneous small power in the congested business portion of the city.

The secondary network of mains may be supported by transformers in vaults with primary feeders or by low-tension feeders from a centrally located sub-station. The primary feeder supply is the more usual as it follows the natural course of development.

As the load density increases the difficulties of getting ventilation and adequate space for the vaults multiply. The installation of a sub-station, centrally located, with alternating-current, low-tension feeders at the proper points, finally becomes the most economical and practical plan. About enough is saved in the cost of the vaults and transformers to offset the extra cost of feeders.

Where there is no direct-current power system provision must be made for alternating-current power service. In smaller cities this is provided for by separate transformers for the elevator service and for the larger general power. This permits the lighting to be served by single-phase, three-wire secondary mains.

In cities where lines are underground in the business district it is very desirable to be able to serve all customers from one set of mains as far as possible. This may be done by the use of four-wire, three-phase, 115-200-volt secondary mains supported by transformers and primary mains, or by low-tension feeders.

The proper distribution of lighting load between phases must be maintained in order to avoid the effects of unbalance. The odd voltages of this system are a bar to its adoption if any considerable number of 220-volt motors are already in service, or if the lamps are rated lower than 110 to 112 volts.

When the load rises above 150 kw. per block, the problems of carrying large volumes of alternating current in lead-sheathed cables multiply, and a condition is reached where direct-current distribution seems to be a practical necessity from the cable standpoint, and the importance of the service requires the protection of the storage battery.

#### Transformer Selection

The determination of probable maximum demands of a user or group of users is of much importance in the selection of transformer sizes. Information based on experience and analysis of demands of different classes of users is necessary to avoid excessive investment in line transformers, as well as unnecessarily large core losses.

The systematic checking of transformer loads by the use of a suitable demand instrument is an important factor in keeping transformer investment within proper limits. This practice is followed by the larger central station companies quite generally. The practice of making contracts with large users on the basis of a demand measured by recording types of demand meters is of great assistance, as the maxima may be kept track of from month to month through the year and added load discovered as soon as it materially affects the demand.

The diversity factor between a group of consumers is so great in some cases that the demand of the group is very

different from the demand of the individual users composing the group. The diversity factor is greater for residence consumers and similar classes whose use varies with their habits of living, than for commercial users whose requirements are fixed by more uniform conditions and whose demands individually are a larger proportion of their connected installation.

The following table represents average experience in the determination of demands of individual consumers and groups of consumers:

Table of Maximum Demand Factors

Classes of Users	Lighting Service	
	Single	Group
Houses and Apartments ...	55 per cent.	20 per cent.
Offices ...	72 " "	60 " "
Small Stores ...	75 " "	60 " "
Hotels ...	35 " "	" "
Churches ...	50 " "	" "
Hospitals ...	60 " "	" "
Manufacturing ...	70 " "	" "
Power Service		
Less than 5 h.p. ...	86 " "	70 " "
6 to 10 h.p. ...	66 " "	62 " "
11 to 20 h.p. ...	65 " "	63 " "
Over 20 to 50 h.p. ...	53 " "	45 " "

The demand is given in this table as a percentage of the connected load.

The construction of alternating-current distributing lines for general service is very largely overhead. The use of underground work is necessarily limited to districts where the load density is such as to warrant the increased expense. In general, underground construction costs from three to five times as much as overhead work, where the load density is such as to require a 2,200-volt main system.

Feeders and primary mains are sometimes placed underground on main thoroughfares, leaving the transformer secondaries and services overhead. This eliminates much of the risk incident to heavily loaded pole lines and avoids putting the more expensive part of the distribution underground.

The cost of distribution systems is materially increased by the necessity of doing the work piecemeal. The plant investment must be made with relation to the income which is likely to be derived within the period immediately following construction. The lines are therefore extended a block or two at a time, as the city grows, and the demand for service increases. The feeder system must be reinforced as may be necessary from time to time, to carry the added load. This involves re-arrangement of connections of primary mains and many complicated "cut-overs" which add to the expense very materially.

#### DISTRIBUTION FOR STREET LIGHTING SERVICE

By Paul M. Lincoln

The problem of distributing power for the specific service of street lighting is quite different from that of power distribution for commercial lighting and other purposes. There are two peculiarities which differentiate it particularly from the usual distribution problem. These are:

1. That the area over which the power for street lighting must be distributed, must, at the same time, be served by an entirely separate general distributing system.

2. That all of the power for street lighting service must be switched at certain predetermined periods of the day, being needed only in the hours of darkness.

The fact that street lighting is required only at night makes it desirable that this particular service shall be fed by a separate distributing system, so that the power for use thereon may be turned on and off at will from a single point.

The alternative to the separate street lighting distributing system is to use the same distributing system for street



lighting as for other purposes and to have the street lamps switched off and on singly or in groups at a point near the location of the lamps. This latter alternative presents so many difficulties that it has been used only to a very limited extent, where groups of lamps are located in a small area such as a small park or playground. Where lines are all underground, it is usually cheaper to give this service from the general network and switch it at various points by hand than to build separate circuits.

The requirements for the simultaneous lighting and extinguishing of all street lamps led to the development and continued use of the so-called "series system." In this system, all of the lamps of a given circuit are operated in series at a constant current. The amount of current used varies with the type of lamp, from a minimum of about four amperes, with some of the more recent types of lamps, to a maximum of approximately ten amperes, which was the standard when Brush brought out his first arc lamps. Ten-ampere series circuits are also the standard current rating for long-burning flame carbon arc lamps, which have recently been developed and are being extensively used in this country. Approximately 20,000 of these lamps have recently been placed in operation in Chicago. The voltage on a circuit varies, of course, with the number of lamps, reaching a maximum of 10,000 to 12,000 volts in some cases. There are at present in use, two methods of securing the constant current required by series street lighting systems:

1. The use of a constant-current generator, in which the voltage varies with the load on the circuit.

2. The use of a constant-current transformer, which receives constant-potential alternating-current energy and delivers constant-current alternating-current energy, the potential of which depends upon the load of the circuit.

The constant-current generator may be either direct-current or alternating-current, but practically all arc machines are of direct-current type. It is noticeable, also, that practically the only type of direct-current arc machine that has survived is the so-called "Brush arc machine," which is a direct descendant of the original machine designed by Charles F. Brush back in the days between 1875 and 1880.

The ease of securing constant alternating current by means of the constant-current transformer, together with the general adoption of constant-potential alternating-current systems for general power supply purposes, has made the use of a.c. constant-current arc service very general. The invention some ten years ago of the mercury arc rectifier has also enabled us to obtain constant direct-current from the constant-current transformers, using, as a source of supply, the standard constant-potential alternating-current systems that have now become standard. Therefore, the use of such constant-current transformers in conjunction with rectifiers has largely taken the place of the constant-current direct-current arc machines, and, as time goes on, the displacement of the arc machine by the rectifier will probably become more and more complete.

The advantages of constant-current operation, as compared to constant-potential for the operation of street lights, are numerous. They are so sweeping as practically to eliminate the constant-potential service for this purpose. They may be enumerated as follows:

1. The lamps may be lighted and extinguished from the central station exactly on any predetermined schedule. This is the fundamental requirement that has made necessary the development of a special distributing system for this purpose.

2. Constant-current circuits, as developed at present, have a relatively small ampere capacity (from four to ten amperes) and are available at a relatively high voltage (8,000

to 10,000). Consequently, the investment in copper for distribution purposes is reduced to a minimum.

3. The constant-current arc lamp system is inherently stable, whereas the constant-potential arc lamp must induce its stability by means of a series resistance of considerable value. The amount of this series resistance is comparatively large in constant-potential circuits, since it is necessary to operate the arc on available commercial voltages which are higher than required. Naturally, therefore, this excessive resistance decreases the efficiency of the constant-potential arc lamp.

4. When metallic filament lamps are used instead of arc lamps on constant current, we also have important advantages. The filaments of the constant-current lamps are of larger diameter and shorter than those demanded by constant-potential lamps, and, as a consequence, the lamp is not only stronger and less liable to damage but also it is subject to smaller radiation losses on account of the smaller area exposed. This latter advantage is particularly noticeable in the "nitrogen-filled" lamp which holds out so great promise of future developments.

A system of street lighting which is a compromise between the constant-potential system for individual lamps and the constant-current system is one in which a series of lamps is operated across a constant-potential circuit. In this system 2,200 or other available voltage is used to operate a series of metallic filament lamps, each series having a sufficient number of lamps to make the total voltage across the series the same as that of the line.

In order to prevent the breakage of a single lamp interrupting service on the entire series, each lamp is shunted by a special reactance coil. This coil is so designed that it takes but a small proportion of the total current of the system while the lamp is burning. If, however, the lamp filament should break, the entire current of the circuit passes through the reactance coil without danger to the coil. This characteristic is obtained by designing the iron circuit of the reactance coil so that it is operated above the bend of the saturation curve when passing the entire current of the circuit. At the same time, it is possible to obtain a curve of regulation, so that a considerable percentage of the total number of lamps on the circuit may be out of service before the current on the whole circuit is reduced beyond allowable limits. In this system we may see a return to a system which was used at least twenty years ago. The writer well recalls the use of these identical devices in the apparatus that was built in 1892.

This system has the material advantage that it does not require switching service for each individual lamp, but that this service may be accomplished at one point for an entire series of 30 to 35 lamps. Also, it is quite possible to group the switches for a number of circuits at one point. By this means, therefore, the cost of switching may be reduced vastly below what would be necessary if each individual lamp required this service.

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At the annual meeting of the Laurentide Company, Limited, Mr. G. Chahoon, Jr., the vice-president and manager, referred to the hydro-electric development being carried out at Grand'Mere, P.Q. He expressed the opinion that there will be a large increase in the demand for power as a result of the war. He said that more inquiries had been received along these lines in the last three weeks than in the previous three months. This was due to the fact that many American manufacturers were contemplating opening branches in Canada. For the present a part of the new construction work will be postponed. During the year \$1,645,299 were spent on the power development.



# Automatic Signals on Victoria Bridge

By Mr. R. F. Morkill\*

Early in July of the present year the Grand Trunk Railway System put into service their new a.c. automatic signals across the Victoria Jubilee Bridge and the approaches thereto, thereby replacing the old Hall disc signals which had been in continuous service there for the last fourteen years. The Victoria Jubilee Bridge across the St. Lawrence River, which connects the Island of Montreal with the mainland, is one of the largest bridges on the American continent—having accommodation for two steam and one electric railroad tracks and also a large roadway and footpath. The steel work is about 6,600 feet in length. This new a.c. installation included the equipping of the double track from Point St. Charles on the Montreal end to Saint Lambert on the south shore of the run—a distance of about  $3\frac{1}{2}$  miles. At the St. Lambert end the automatics tie into the new 64 lever G.R.S. all-electric interlocking plant. Four other railroads lease running rights from the Grand Trunk over this bridge, namely, the Central Vermont, the Delaware & Hudson, the Quebec, Montreal & Southern and the Intercolonial. On account of extremely heavy traffic the length of the blocks was made comparatively short—ranging from 2,500 to 3,600 feet.

The installation in general follows the latest recommended practice in a.c. signal work. The signals are the Union Switch & Signal Company's top post T-2 mechanism operated by a single phase 110 volt, sixty cycle a.c. induction motor. The so-called wireless control circuits are used, employing the Union Model 12 polyphase, three position relay; the local coils of these relays receive their energy at 12 volts potential from the track transformers. Track transformers also supply the energy for track circuits and electric signal lamps. All signals are electric lighted by two 2 c.p.,  $2\frac{1}{2}$  watt, 6 volt tungsten lamps burning in multiple; Dressel convertible R.S.A. lamps equipped with Model 9 electric sockets are used.

The centre span of the bridge has a steel floor system which necessitated the use of a trap circuit; two vane type relays are used on this trap circuit.

All main line switches are equipped with Universal switch circuit controllers and Z type switch indicators operating at 110 volts. The indicators are of the normally energized type standing when clear at 45 degrees in the upper right hand quadrant.

The high and low tension line wires are supported on a single cantilever cross arm, the two high tension wires being placed on the outside and spaced 18 inches apart and the low voltage wires on the inside and spaced 12 inches apart. On the bridge this cantilever cross arm is attached to the vertical bridge members and off the bridge to the steel poles of the Montreal Light, Heat & Power Company, which run along the G. T. R. right-of-way. Due to the difficulty of double arming, a special forked bracket pin was used set on a single cross arm as shown in Fig. 1.

No. 6 B & S gauge hard drawn d.b.w.p. insulated copper wire was used for the high tension line. Dossert solderless cable taps were used to connect the leads running from the high tension line to the transformer primaries. No. 19 B & S gauge 40 per cent. copper clad wire with d.b.w.p. insulation was used for the low voltage line. MacIntyre copper line sleeves were used throughout in making all joints in line wire.

On the bridge proper all wires are enclosed in sherardized conduit with conduit fittings so that in no case are wires exposed. No wooden trunking whatever is used on the bridge

structure. Reference to Fig. 1 will give a general idea of how the conduit work was installed.

On the bridge structure proper great difficulty was experienced in getting the necessary clearance for the signal blade without placing it so high as to have it obscured from the engine man's view by the steel work. The difficulty was overcome by using a style T-2 dwarf signal mechanism set on a steel cantilever platform which was rivetted to the end post of the truss. The spectacle casting was a special design with the blade attached to the bottom of the casting so as to give the maximum clearance and best view, yet arranged so that as it moved from the stop to clear positions, at no point would the clearance be decreased below that of the blade in the stop position. The platform, signal mechanism, and spectacle are clearly shown in Fig. 1. On this same platform is mounted an ordinary relay post and box in which are placed the relays, track transformer, reactances, and low voltage lightning arresters. The line transformer and high

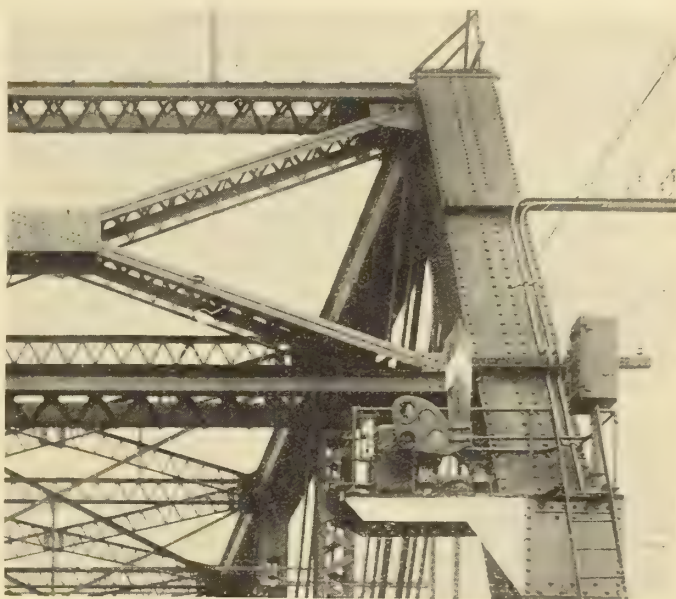


Fig. 1—Signal system on Victoria St. bridge.

voltage lightning arresters are also mounted on the platform. Reference to Fig. 1 shows the general arrangement.

Power for operating these signals is obtained over a single phase, 60 cycle, 2200 volt transmission line. Under normal conditions power is purchased from the Montreal Light, Heat & Power Company. The a.c. transmission line is sectionalized at two points so that a transmission line failure will not necessarily tie up the entire installation. General Electric Company double pole, Form P, out door type oil switches are used for this purpose. At the east end of the bridge the switch is mounted on the transmission pole line. The pole is provided with steps and painted white so as to facilitate finding it at night in case of failure. The sectionalizing switch at the west end of the bridge is mounted on a steel platform attached to a large "A" frame steel transmission line support of the Montreal Light, Heat & Power Company.

General Electric Company multigap type, Form F2, lightning arresters, enclosed in asbestos lined weather-proof wooden boxes, are used to protect the high tension transmission line. Two of these are placed at every transformer location. Off the bridge structure No. 3 Paragon ground

\* Signal Engineer, Grand Trunk Ry. Co.



cones, set in coke, were used for high tension lightning arrester grounds. On the bridge structure both the high and low tension lightning arresters were grounded to the steel work of the bridge. A bare No. 6 B & S gauge, 40 per cent. copper clad, line wire was strung the entire length of the bridge and grounded at each end through a No. 3 Paragon ground cone set in coke. At each signal or transformer location the bridge structure was connected to this ground wire. Off the bridge structure the low tension lightning arresters were grounded through a coil of 12 turns of No. 6 B & S gauge bare copper wire placed one foot below the concrete foundation. Low voltage lightning arresters were used in all wire leads to either line or track.

In the St. Lambert interlocking plant there was installed an auxiliary power supply consisting of a storage battery, d.c. - a.c. motor-generator set, and step up transformer, together with the necessary switching apparatus. This auxiliary plant has sufficient capacity to operate the interlocking plant and a.c. signal system for about five hours. Due to the extremely heavy traffic over this installation a continuity of signal service was essential and therefore an auxiliary power supply was installed. The Montreal Light, Heat & Power Company bring their energy into Montreal over six independent power lines and in addition have a

fail, a circuit breaker would automatically open. The auxiliary power set would then start up, the 200 ampere hour storage battery supplying the energy necessary to operate both the a.c. signal system and the d.c. all-electric interlocking plant. The d.c. generator is run as a motor and the special 3-phase induction motor is operated as a single phase a.c. generator supplying a.c. 60 cycle energy at about 200 volts. This is then stepped up to 2200 volts and fed out on the a.c. signal transmission line.

The d.c. - a.c. motor-generator—generator-motor set is mounted on a concrete foundation. Besides this are mounted the two switchboard panels and beyond is the storage battery room. On the wall are mounted the disconnecting switches and fuse blocks. All transformers are of the out-door type and located on poles outside the tower. All wire leads between pole line, transformers and tower are in cable enclosed in sherardized conduit.

This installation is the first of its kind in Canada. All signal apparatus was manufactured and installed by the Union Switch & Signal Company. Switchboards and power equipment were purchased from the General Electric Company, and installed by the railway company's forces.

### Montreal Notes

Some weeks ago the City Council appointed Messrs. M. J. Butler and P. Gagnon a commission to prepare a report on the value of the property of the Montreal Water and Power Company. This step was taken in view of the prospect of the city purchasing the company's property. The report, which has just been handed in, places the value of this property at approximately \$7,000,000.

About forty members of the Montreal Electrical Society on September 5 visited the shops of the Montreal Tramways Company at Youville, just outside the city. The shops are used for assembling and repairing cars and are exceptionally well equipped for this purpose, being so arranged as to provide for economy in handling cars and parts. The Hamburg, Germany, new car shops are modelled entirely on the Youville plan. The machinery is electrically driven, d.c. being used in all shops, with the exception of the carpenters', where 3-phase 220 volt current is employed. The members of the Society were met at the St. Denis Street office by Mr. D. E. Blair, superintendent of rolling stock, and members of his staff and taken in a special car to Youville, where Mr. Blair conducted the members over the shops, explaining the methods of working, etc.

The Montreal Light, Heat and Power Company have given \$10,000 to the Canadian Patriotic Fund, while the employees of the company are each donating a day's pay. Mr. J. S. Norris, the general manager and secretary, has issued a bulletin supplementary to the one published in our last issue. This reads: "Inasmuch as reserves were not provided for, the management is now pleased to announce that English and French reservists (employees of the permanent force) enlisting for active service in the present war will retain their status as employees as regards pension fund and other benefits, with an allowance of \$1.00 per day for married men and 75c per day for single men from the date of enlisting to the date of discharge or death (not exceeding six months) on presentation of enlistment and discharge papers duly certified by departmental manager, enlistment papers to be submitted before leaving and discharge papers after returning to the country. If desired accrued pay as above will be paid fortnightly to employees' dependents on order." The published lists of Montreal men volunteering for the front contain a very large number connected with various branches of the electrical industry.

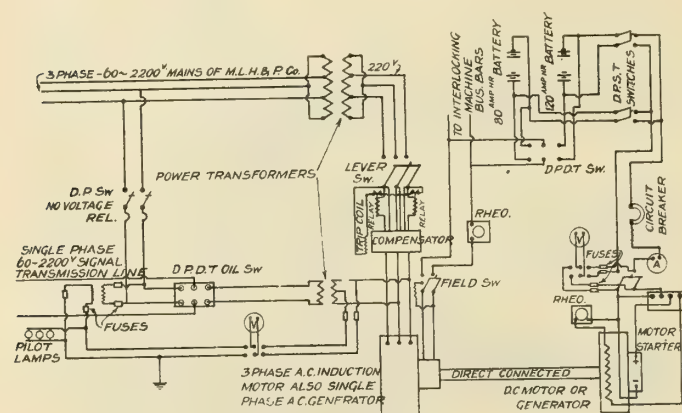


Fig. 2—Arrangement of supply apparatus.

large reserve steam plant so that a power failure lasting more than five hours should be a very rare occurrence.

The former power equipment at the St. Lambert all-electric plant was enlarged and changed to provide both the d.c. for the all-electric interlocking plant, and in cases of emergency, a.c. energy for the a.c. signal system.

Fig. 2 shows diagrammatically the arrangement of this apparatus. Normally 3 phase, 60 cycle energy, at 2200 volts, is purchased from the Montreal Light, Heat & Power Company. This is stepped down to 220 volts by 3 single phase out door type transformers, mounted on a pole outside the tower. This 220 volt energy is then led to a special 3-phase a.c. induction motor which drives a d.c. generator. This generator is used to charge two storage batteries—one of 80 ampere hour and one of 120 ampere hours capacity. Switchboard equipment is such that any one of the following combinations can be arranged:—

- Charge both batteries at the same time.
- Charge either battery separately.
- Charge one battery and have the other supplying energy for the all-electric interlocking plant.
- Have one battery supplying energy for the all-electric interlocking plant and the other supplying energy to operate the d.c. - a.c. motor generator set.
- Have either battery supply energy to the all-electric interlocking plant.

Normally the a.c. signal transmission line is fed right off one phase of the 2200 volt, 3 phase, a.c. line entering the St. Lambert interlocking tower. Should this energy



# Standardized Rules and Definitions

The American Institute of Electrical Engineers has adopted, subject to editorial revision, a number of definitions and rules called "standardization rules." This is the outcome of a large amount of work which has been proceeding since 1898 as the result of the appointment at that time of a Committee on Standardization, the personnel of which has been changed and enlarged from time to time as requirements appeared to demand. The standardization rules include 567 topics. A large number of these are definitions which have reference to subjects of almost daily interest to electrical engineers and operating men. We are reproducing a number of these herewith and others will follow as space permits. In these standardized definitions it is to be understood that those about which there can be no misunderstanding are, for the most part, omitted.

## Definitions

Note. The following definitions are intended to be practically descriptive, and not scientifically rigid.

### CURRENT, E.M.F. and POWER

(The definitions of currents given below apply also, in most cases, to electromotive force, potential difference, magnetic flux, etc.).

1. **A Direct Current** is a unidirectional current. As ordinarily used, the term designates a practically non-pulsating current.
2. **A Pulsating Current** is a current which pulsates regularly in magnitude. As ordinarily employed, the term refers to unidirectional current.
3. **A Continuous Current** is a practically non-pulsating direct current.
4. **An Alternating Current** is a current which alternates regularly in direction. Unless distinctly otherwise specified, the term "alternating current" refers to a periodic current with successive half waves of the same shape and area.
5. **An Oscillating Current** is a periodic current whose frequency is determined by the constants of the circuit or circuits.
6. **Cycle.** One complete set of positive and negative values of an alternating current.
7. **Electrical Degree.** The 360th part of a cycle.
8. **Period.** The time required for the current to pass through one cycle.
9. **Frequency.** The number of cycles or periods per second. The product of  $2\pi$  by the frequency is called the angular velocity of the current.
10. **Root-Mean-Square or Effective Value.** The square root of the mean of the squares of the instantaneous values for one complete cycle. It is usually abbreviated r.m.s. Unless otherwise specified, the numerical value of an alternating current refers to its r.m.s. value. The r.m.s. value of a sinusoidal wave is equal to its maximum value divided by  $\sqrt{2}$ . The word "virtual" is sometimes used in place of r.m.s., particularly in Great Britain.
11. **Wave-Form or Wave-Shape.** The shape of the curve obtained when the instantaneous values of an alternating current are plotted against time in rectangular co-ordinates. The distance along the time axis corresponding to one complete cycle of values is taken as  $2\pi$  radians, or 360 degrees. Two alternating quantities are said to have the same wave-form when their ordinates of corresponding phase (see § 13) bear a constant ratio to each other. The wave-shape, as thus understood, is therefore independent of the frequency of the current and of the scale to which the curve is represented.
12. **Simple Alternating or Sinusoidal Current.** One whose wave-shape is sinusoidal. Alternating-current calculations are commonly based upon the assumption of sinusoidal currents and voltages.
13. **Phase.** The distance, usually in angular measure, of the base of any ordinate of an alternating wave from any chosen point on the time axis, is called the phase of this ordinate with respect to this point. In the case of a sinusoidal alternating quantity, the phase at any instant may be represented by the corresponding position of a line or vector revolving about a point with such an angular velocity ( $\omega = 2\pi f$ ) that its projection at each instant upon a convenient reference line is proportional to the value of the quantity at that instant.
14. **Non-Sinusoidal Quantities** are quantities that cannot be represented by vectors of constant length in a plane, and the following definitions of phase, active component, reactive component, etc., are not in general applicable. Certain "equivalent" values, as defined below, may, however, be used in many instances, for the purpose of approximate representation and calculation.
15. **Crest-Factor or Peak-Factor** is the ratio of the crest or maximum value to the r.m.s. value. The crest factor of a sine-wave is  $\sqrt{2}$ .
16. **Form Factor** is the ratio of the r.m.s. to the algebraic mean ordinate taken over a half-cycle beginning with the zero value. If the wave passes through zero more than twice during a single cycle, that zero shall be taken which gives the largest algebraic mean for the succeeding half-cycle. The form factor of a sine-wave is 1.11.
17. **Distortion Factor** of a wave is the ratio of the r.m.s. value of the first derivative of the wave with respect to time, to the r.m.s. value of the first derivative of the equivalent sine-wave.
18. **Equivalent Sine Wave.** A sine wave which has the same frequency and same r.m.s. value as the actual wave.
- \*19. **Phase Difference: Lead and Lag.** When corresponding cyclic values of two sinusoidal alternating quantities of the same frequency occur at different instants, the two quantities are said to differ in phase by the angle between their nearest corresponding values, e.g., the phase angle between their nearest ascending zeros or positive maxima. That quantity whose maximum value occurs first in time is said to lead the other, and the latter is said to lag behind the former.
- \*20. **Counter-Clockwise Convention.** It is recommended that in any vector diagram, the leading vector be drawn counter-clockwise, with respect to the lagging vector.
- \*21. **The Active or In-Phase Component** of the current in a circuit is that component which is in phase with the voltage across the circuit; similarly the active component of the voltage across a circuit is that component which is in phase with the current. The use of the term energy component for this quantity is disapproved.



- \*22. The Reactive or Quadrature Component** of the current in a circuit is that component which is in quadrature with the voltage across the circuit; similarly the reactive component of the voltage across the circuit is that component which is in quadrature with the current. The use of the term wattless component for this quantity is disapproved.
- \*23. Reactive Factor** is the sine of the angular phase difference between voltage and current, or the ratio of the reactive current or voltage to the total current or voltage.
- \*24. Reactive Volt-Amperes.** The product of the reactive component of the voltage by the total current, or of the reactive component of the current by the total voltage.
- \*25. Non-Inductive Load and Inductive Load.** A non-inductive load is a load in which the current is in phase with the voltage across the load. An inductive load is a load in which the current lags behind the voltage across the load. A condensive or anti-inductive load is one in which the current leads the voltage across the load.
- 26. Power in an Alternating-Current Circuit** is the average value of the products of the coincident instantaneous values of the current and voltage for a complete cycle, as determined by a wattmeter.
- 27. Volt-Amperes or Apparent Power.** The product of the r.m.s value of the voltage across a circuit by the r.m.s value of the current in the circuit. This is ordinarily expressed in k.v.a.
- 28. Power Factor** is the ratio of the power (cyclic average as defined in §26) to the volt-amperes. In the case of sinusoidal current and voltage, the power factor is equal to the cosine of their difference in phase.
- 29. Equivalent Phase Difference.** When the current and e.m.f. in a given circuit are non-sinusoidal, it is customary, for purposes of calculation, to take as the "equivalent" phase difference the angle whose cosine is the power factor (see §28) of the circuit. There are cases, however, where this equivalent phase difference is misleading, since the presence of harmonics in the voltage wave, current wave, or in both, may reduce the power factor without producing a corresponding displacement of the two wave forms with respect to each other; e.g., the case of an a.c. arc. In such cases the components of the equivalent sine waves, the equivalent reactive factor and the equivalent reactive volt-amperes may have no physical significance.
- 30. Single-Phase.** A term characterizing a circuit energized by a single alternating e.m.f. Such a circuit is usually supplied through two wires. The currents in these two wires, counted positively outwards from the source, differ in phase by 180 degrees or a half-cycle.
- 31. Three-Phase.** A term characterizing the combination of three circuits energized by alternating e.m.f.'s which differ in phase by one-third of a cycle; i.e., 120 degrees.
- 32. Quarter-Phase, also called Two-Phase.** A term characterizing the combination of two circuits energized by alternating e.m.f.'s which differ in phase by a quarter of a cycle; i.e., 90 degrees.
- 33. Six-Phase.** A term characterizing the combination of six circuits energized by alternating e.m.f.'s which differ in phase by one-sixth of a cycle; i.e., 60 degrees.
- 34. Polyphase** is the general term applied to any system of more than a single phase. This term is ordinarily applied to symmetrical systems.
- 35 Per Cent Drop.** In electrical machinery, the ratio of the internal resistance drop to the terminal voltage is called the "per cent. resistance drop."
- 36.** Similarly the ratio of the internal reactance drop to the terminal voltage is called the "per cent reactance drop."
- 37.** Similarly the ratio of the internal impedance drop to the terminal voltage is called the "per cent impedance drop."
- Unless otherwise specified, these per cent drops shall be referred to rated load and rated power factor.
- 38.** In the case of transformers, the per cent drop will be the primary drop (reduced to secondary turns) plus the secondary drop, in per cent of secondary terminal voltage.
- 39.** In the case of induction motors, it is advantageous to express the drops in per cent of the internally induced e.m.f.
- 40. The Load Factor** of a machine, plant or system is the ratio of the average power to the maximum power during a certain period of time. The average power is taken over a certain period of time, such as a day, a month, or a year, and the maximum is taken over a short interval of the maximum load within that period.
- In each case, the interval of maximum load and the period over which the average is taken should be definitely specified, such as a "half-hour monthly" load-factor. The proper interval and period are usually dependent upon local conditions and upon the purpose for which the load factor is to be used.
- 41. Plant Factor** is the ratio of the average load to the rated capacity of the power plant.
- 42. The Demand** of an installation or system is the load which it puts on the source of supply, as measured at the receiving terminals. The demand may be as specified, contracted for, or used. It may be expressed either in kilowatts, kilovolt-amperes, amperes or other suitable units.
- 43. Maximum Demand** of an installation or system is its greatest demand, as measured not instantaneously but over a suitable and specified interval, such as a "five-minute maximum demand."
- 44. Demand Factor** is the ratio of the maximum demand of any system or part of a system to the total connected load of the system, or of the part of system, under consideration.
- 45. Diversity Factor** is the ratio of the sum of the maximum power demands of the subdivisions of any system or parts of a system to the maximum demand of the whole system or of the part of the system under consideration, measured at the point of supply.
- 46. Connected Load.** The combined continuous rating of all the receiving apparatus on consumers' premises connected to the system or part of the system under consideration.
- 47. The Saturation Factor** of a machine is the ratio of a small percentage increase in field excitation to the corresponding percentage increase in voltage thereby produced. Unless otherwise specified, the saturation factor of a machine refers to the excitation existing at normal rated speed and voltage. It is determined from measurements of saturation made on open circuit at rated speed.



48. **The Percentage of Saturation** of a machine at any excitation may be found from its saturation curve of generated voltage as ordinates, against excitation as abscissas, by drawing a tangent to the curve at the ordinate corresponding to the assigned excitation, and extending the tangent to intercept the axis of ordinates drawn through the origin. The ratio of the intercept on this axis to the ordinate at the assigned excitation, when expressed in percentage, is

the percentage of saturation and is independent of the scales selected for excitation and voltage. This ratio, as a fraction, is equal to the reciprocal of the saturation-factor at the same excitation, deducted from unity, or if  $f$  be the saturation factor and  $p$  the percentage of saturation,

$$p = 100 \left\{ 1 - \frac{1}{f} \right\}$$

## Deterioration of Porcelain Insulators

By J. A. Brundige \*

While it has been recognized practically since the inception of the electrical art that the commoner insulating materials, such as rubber and compound treated fabrics, are subject to more or less rapid destruction when under the influence of continued electrical stress, the more solid insulating bodies, like glass and porcelain, were looked upon as being permanent in their characteristics and it was considered that they could be relied upon indefinitely to perform their functions. This idea in the minds of engineers has persistently held, even though a few pioneers a number of years ago suggested that it was not impossible that glass and porcelain might be subject to molecular fatigue when acted upon by electrical forces for long periods, similar to that exhibited by metals under repeated mechanical stresses. Now it is safe to assume that the majority of operating engineers, having to deal with higher voltage transmission lines, have had experiences which lead them to believe in the theory of electrical fatigue in porcelain. Whether this comes about solely through the continued application of the normal operating voltage or whether it is due to the transient overvoltages which are unavoidable on any line, is hard to say, but the existing evidence points to the latter conclusion.

It must not be understood that all or even the greater portion of the failures experienced with suspension type insulators are due to molecular deterioration of the porcelain. A large number of the failures have been traceable to improper design of the insulator parts or to an unsuitable porcelain body.

It has been the experience of a number of transmission companies to have practically no insulator trouble for the first couple of years of operation; then the insulators began to fail in increasingly greater numbers, for no apparent reason. Closer examination, however, sometimes revealed the fact that minute checks had formed all over the surface of the porcelain, and that the failure had been due to a crack extending clear through the shell. This behavior of the porcelain has not been confined to any kind or type of insulator nor to any one manufacturer's product.

The principal requisites for a good porcelain for high-voltage insulators, are high dielectric strength and mechanical toughness. These two qualities are somewhat opposed to each other in the actual manufacture, for when a high dielectric strength is obtained, the porcelain is apt to be brittle like glass. It is possible, however, to arrive at mixtures which exhibit both properties to a marked extent when the firing has been properly done, although it is regrettable that some so-called high-voltage porcelains appear to be lacking in both of these properties.

This can be better understood when it is learned that the mixtures used by two prominent manufacturers, each putting out a product which is accepted as reasonably good, vary greatly in the proportion of ingredients employed. While the feldspar contents of the two mixtures are of the

same order, one has twice as much flint as the other, and the quantities of ball clay and china clay vary as much as three to one. Yet the different manufacturers regard their mixing formulas as trade secrets, and the proportions are religiously followed down to tenths of one per cent. This latter is doubtless done for the sake of uniformity of product, which is important, but until the mixtures more nearly approach a recognized standard, it appears that more or less trouble may be expected with high-tension insulators.

Doubtless, the factor having more to do with the failure of insulators than the porcelain body is the design; or in other words, not only must the electrical characteristics of the insulator, such as puncturing and flash-over values, both of which are highly important, be considered, but also the size and shape of the parts as well. With certain pin type insulators, especially those mounted on metal pins, cracks have been observed in quite a number of the petticoats. These were evidently expansion effects due to temperature changes. The same effects have been noticed to a greater extent with the suspension type insulators provided with metal caps and pins. We have here porcelain, cement and iron assembled together, the coefficients of temperature expansion of the three being quite dissimilar. In this latitude the temperature variation between summer and winter days is well in excess of 100 deg. fahr., and it can be appreciated that enormous internal strains must be set up inside of the caps. The porcelain being the least able to withstand these forces, is the part that suffers and cracks, with the attendant electrical punctures ensuing. In the case of an insulator designed for high mechanical strength in tension, which necessarily means a rather high cap with correspondingly long pin, the temperature changes cause a marked variation in the length of the pin, which is in contact with the porcelain through means of a layer of cement for a distance of sometimes  $2\frac{1}{2}$  to 3 inches along its length. The great strain to which the porcelain is subjected is then apt to produce cracks perpendicular to the axis of the pin, which has actually been found to be the case in a large number of instances. These cracks, however, are mostly very minute and can hardly be detected by the eye if the cap and the cement have been carefully removed. A line of ink drawn over the surface of the porcelain, however will nearly always disclose the cracks, as the ink will be drawn along them by capillary action.

The method of failure of suspension insulators with metal caps and pins is often quite characteristic. Cracks develop at some point inside the cap, and when the current leakage through them is sufficient, a path is fused through the porcelain by the intense heat generated. If the heating takes place relatively slowly, a hole is apt to be fused through the cap, through which gases and melted porcelain are forcibly expelled, but the insulator usually holds together and continues to support the cable. With a large amount of power back of the break, which may act in the nature of a short cir-

\* Read and discussed before the A. I. E. E.



cuit inside the insulator, caps have been known actually to explode, in which event the line conductor is allowed to fall. Before the burning of the caps can take place, it is necessary that several of the units of an insulator string be bad, and instances have been observed where all the caps of ten-unit insulators have been so affected. With the better methods for locating cracks and faults as soon as they have developed, such as the high-range megger, the pyrotechnic displays above described have become fewer.

Because of several instances of trouble of this character having recently been observed in connection with suspension type insulators, some engineers have been led to believe that they are unsuccessful, which conclusion is wholly unwarranted.

The high-range megger has proved to be an extremely useful instrument for the locating of insulator faults undiscoverable so far as ordinary means of inspection are concerned. Tests made on a large number of units later checked up by tests with a high-tension transformer, have shown that the megger can be absolutely depended upon if reasonable care is used to see that there is no leakage in the conducting leads. To show the sensitiveness of the megger, the two electrodes can be placed within  $\frac{1}{4}$  in. of each other on a glazed porcelain surface or upon a fractured surface where there is no glaze and the reading will be practically infinity. By blowing the breath upon this surface even when the porcelain is at a moderately high temperature, the moisture so deposited will be sufficient to give a comparatively low reading on the needle. When a crack occurs in the porcelain up inside the cap there is always sufficient moisture present in the cement to give an indication on the needle, which need not be confounded with surface leakage, if the insulator is at all reasonably clean. If the insulators are so dirty that surface leakage is marked, they should be cleaned before the megger test. Certain insulators may give a reading of from 40 to 100 megohms, and if later tested with a high-tension transformer they will not fail immediately upon the application of voltage, but may hold up until 30,000, 50,000 or even 60,000 volts is reached before puncturing. Those which show a zero reading on the megger will stand no voltage from the testing transformer.

An interesting experiment was recently made by immersing a batch of insulators in water at ordinary temperature and slowly bringing them up to the boiling point. Twenty insulators, some two or three years old, were tested in this manner and every one was found to be ruined by the time boiling point was reached. These were from two different manufacturers, one of whom has previously delivered batches of insulators where bringing them to the boiling point of water was one of the routine requirements before the insulators left the factory. Other similar tests made on new insulators of the same design did not produce failure, except in a few units. The probable explanation of this is that in the new insulators the cement had not yet attained its ultimate hardness, and allowed the expansion to take place in the pin without cracking the porcelain.

The data at hand upon insulator failures are unfortunately very incomplete, and until these are collected and have been studied, all designs brought forward must necessarily be lacking in some respect. Enough is already known, however, to indicate the general direction which the new designs will follow, and it may be confidently predicted that the troubles experienced will be materially lessened in the immediate future.

#### Discussion

**Charles E. Waddell:** Reference was made in Mr. Brundige's paper to the fatigue of porcelain. I want to suggest that this fatigue, perhaps, is not due alone to the electrical stresses, but to a combination of electrical and mechanical

stresses. The majority of insulators strung up and sustaining only their own weight successfully withstand laboratory test for flash-over and puncture. The same strings of insulators when placed on the line and supporting the weight of the conductor, which may be 1,000 lb. (453 kg.) or more, break down under a very slight rise in voltage. The only conclusion I have been able to reach in the matter is, that, due to some obscure phenomenon, the dielectric strength of the insulators is weakened, and that if the mechanical stresses were removed the insulation would in all probability be as high as when actually tested.

**Percy H. Thomas:** The most important topic brought up it seems to me, is the matter of the so-called deterioration of porcelain. It has developed to a critical point during the last year in many different parts of the country and with many different kinds and makes of insulators. It has developed, sometimes, where it could not possibly be due to electrical causes; and sometimes it is an open question whether it is not due to electrical causes. The problem is to find out as quickly as possible what it is, and how to overcome it.

I think we can conclude that it is not due to the deterioration of porcelain per se, for, taking the worst cases of breakdown of insulators, there are many insulators which are, apparently, absolutely uninjured, or, in any which are injured, the material is good. It is, in my opinion, therefore not a deterioration of the porcelain per se. It is not always due to the presence of electrical potential. I think that in all probability a great deal of it is due to the processes of manufacture. When you consider that the material at one time is in a plastic state, and that when it is burned it has to shrink into a semi-crystalline mass, keeping every portion intact, you can see that, during the forming, the pressing and the twisting it gets, somewhere on the interior there is a slight plane of separation formed. The edges may be daubed over and adhere, yet this fault will never be corrected. There may be enough good porcelain to hold the potential during the test, while the insulator is new, before the faults develop. I think the evidence of the general situation points to this conclusion.

You cannot blame the manufacturers for it, exactly, as they are doing the best they can, and there is no one manufacturer who has all the trouble; they all say they are having trouble, and it is a problem which we must work out with time, and we must find some way of detecting the bad insulators. This can partly be done by tests, but we need a few new tests.

If we can assume that the difficulties in high-tension insulators are, most of them, due to defects depending upon the history of the individual insulator, that puts a premium on the two-piece insulator immediately. You have two shells independently made, and put them together. If one shell is defective you will not, in all probability, have another defective shell along with that. But if you use the two-piece insulator, you must have its flash-over voltage so low that a single piece of porcelain will be sufficient to withstand the full strain and prevent a puncture. If you are relying on one shell when the other is injured, you must be sure to have that shell built to take care of the flash-over by itself alone. This double-piece insulator has a great advantage mechanically, in that, if due to expansion, or heavy stress, there is a little check on the inner petticoat, due to mechanical reasons, that still leaves the outer shell intact. The mechanical strains on the outer shell are far less, on account of the larger hole in which the cement is placed. We will say that this two-piece insulator, which I have in mind, flashes over at about 90,000 volts, and has a puncture stress, depending on how quickly the voltage is brought up, between 190,000 and 200,000 volts—that is, more than 2 to 1—if you do not keep the voltage on more than two or three



seconds in bringing it up. This is, I believe, an exceedingly important matter. A number of these insulators have been given a high-frequency test, 250,000 and 300,000 volts, considerable capacity, with long series gaps, and they have shown up very well.

**Farley Osgood:** I think the manufacturers of our various lines of materials are doing about all that can be expected of them in the way of investigation for improvement. I do not think that the operating engineers, as a whole, are doing their share of investigating work. I think that it is up to the operating engineers to plan to spend sufficient money for proper testing schemes and devices, in order to help the manufacturers and designing engineers in the field, so that they can test in actual practice.

A point which has brought this matter vividly to my mind within the year has been our own considerable expenditure toward the investigation of the effect of high frequencies on the insulators and lines, and we found that insulators which had behaved reasonably well, as we thought, broke down very quickly under our high-frequency test.

Mr. Faccioli brought out clearly that the difficulties from voltage can be reasonably well cared for, and the difficulties from short circuits can be reasonably well cared for, particularly by means of reactance, but I do not agree with him at all that we should keep away from frequent switching. It cannot be done, in a complicated, busy territory. In our large power stations, with a heavy service, we will switch for one cause and another, twenty to sixty times a day. It cannot be stopped. It has to be done. The engineers have to meet these conditions. I entirely agree with Mr. Lincoln that if the apparatus will not meet the service requirements it must be made to.

In my opinion, the difficulties from high frequencies are not well enough understood. The reason they have not been given careful study previously is because we have been so busy eliminating the difficulties from short circuits, high pressures, etc. Having cared for these, we can now take up the study of the effects of high frequencies. If we had done this before, many of our present difficulties would not have been known to us.

**J. A. Sandford, Jr.:** Mr. Brundige has suggested that engineers put into every insulator specification a description of the materials to be used. I do not believe that is a possibility. I had occasion to look up not long ago the chemical analysis as laid down for what we call ball clay, or kaolin, from Kentucky, North Carolina, Georgia, one or two places in England, and one in France. You could lay these in a row here on this table and label them, and then take the labels off, and change them around, and you would never know which applied to which, they are so nearly the same. The great difference between the various clays used seems to be in their plasticity, but no one can tell what plasticity is or what causes it. Therefore, I think Mr. Brundige's suggestion would prove impracticable, particularly at the present time, with our limited knowledge of such things.

Second, on the question of fatigue of porcelain. I think that if a piece of porcelain is absolutely vitrified there is absolutely no fatigue. To my mind, what has been called fatigue of porcelain is simply the gradual giving way of porcelain that, in the first place, was not perfect, either through flaws, or from the vitrification standpoint.

To refer to a different matter, I think that a large percentage of the insulator failures on transmission lines would have been eliminated if, every time the patrolman went out to change an insulator—this has reference particularly to suspension type insulator lines—he had taken down the complete string of insulators and substituted a complete string of new insulators which he was sure were good. If you go out and look at a string of insulators on which you know there is trouble, there may be two or three disks that you

can see are no good, and there may be two or three that look as if they are all right, and they may or may not be so.

**William L. Puffer:** I am very much interested in what has been said concerning the life, deterioration of and failure of the several types of insulators in common use, because of an investigation of mine into the cause of undue leakage over the busbar cell-work and insulations of a moderately high tension station.

In this station it was known that there was some kind of ground or similar trouble, because at times tiny sparks had been noted at the heads of bolts and washers used in assembling the insulating slabs, and several disagreeable shocks had been received by attendants. As soon as possible a section was cut out of service and the parts dismantled, and to my surprise there was found a large collection of wet green paste on the copper bolts and studs. Chemical examination proved the presence of nitric acid, water, nitrate of copper and several sub-nitrates. The surface of the porcelains and all pores and cracks were wet with nitric acid of sufficient strength to destroy organic washers that had been used to distribute the pressure between the porcelain and the clamping nuts and bolts.

Further examination proved the presence of nitric acid in the cracks of both wet and dry process porcelain bushing, on the surface of the insulating coverings of the busbar cables and on the porcelain bushings used to support the cables where they passed through walls and barrier.

I was able to prove that all of the trouble originated in the small air spaces where the potential gradient was high enough to produce light and minute sparks of the type called "static." First there was produced ozone, then nitric acid and then action on the copper with the formation of nitrates. Similar action was found about some iron washers and bolts used in the construction of switches and the switchboard.

These results were not a matter of conjecture but of actual chemical proof obtained while the parts were alive and carrying current, and it certainly suggests that if a 6,600-13,200 volt system can be subject to as great action as I found, there is ample room for thought as to what must be the conditions around the insulating parts of the highest tension lines now in use.

Whenever and wherever an insulating support shows a glow with little sparks in it there is likely to be the formation of ozone, and if a little moisture is present there will next be nitric acid. The wind may blow it all away, or a porous porcelain may slowly absorb it, with gradually lessening resistance, leading finally to a puncture and a short-circuit.

**Julian C. Smith:** I think operating men who have had experience in operating transmission lines of 50,000 volts and upwards, with pin type insulators, realize there has been a decided deterioration in the pin type insulators. The fact that it is easier to find the deterioration in the suspension type insulator, easier to replace the defective parts, would by no means indicate that the suspension type, per se, is any worse than the pin type. This is the more evident when you consider that practically all suspension type insulators are operating with one end grounded, whereas a relatively small number of pin type insulators subjected to the same voltage, are operating under these conditions.

**E. M. Hewlett:** In reference to the fatigue of porcelain, I have not seen the proof that well-vitrified porcelain undergoes fatigue, unless overstrained. From anything we have seen so far, I believe that what is known as fatiguing is largely the result of flaw of some description or of incomplete vitrification. That is, when not properly vitrified, the insulators will eventually absorb moisture. The glaze will protect the insulator for a time, but gradually deteriorates and then absorption through the porcelain begins and the unbaked porcelain gradually absorbs moisture and breaks down.



# Electric Railways

## A Double-Deck Car Barn

Work is already well advanced on the construction of a car barn for the B. C. Electric Railway Company, Limited, at Vancouver, B.C., the estimated cost of the structure being \$350,000.

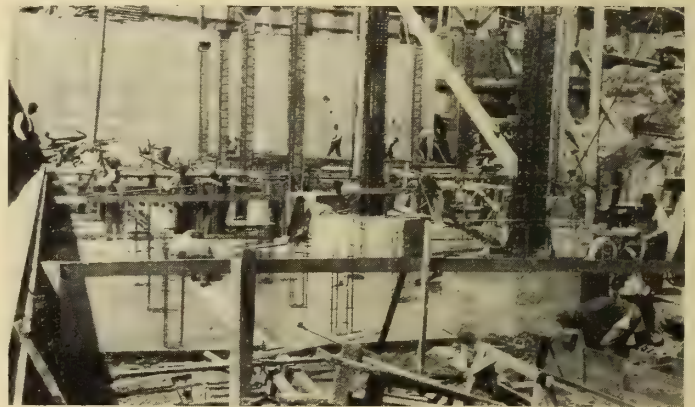
Some years ago the company purchased an entire city block in the Mount Pleasant district with the idea of utilizing the block for car barn purposes. The block has a frontage on Main Street, one of the principal car line streets in the district, and extends to Quebec Street, the other boundary streets being Thirteenth Avenue and Fourteenth Avenue. On the north half of the block the company several years ago erected two car barns of the galvanized iron type of construction, capable of accommodating 60 cars. The new barn now in course of construction is located on the south end of this block and adjoins the old structure. The new barn will be two storeys in height on Main Street and one-storey in height on Quebec Street, the difference in grade between the two streets being such as makes this plan possible. The dimensions are about 350 feet by 130 feet, the height of each storey being approximately 20 feet. On the ground floor the entire area will be available for the housing of cars, the ten trucks making provision for 62 cars. The Quebec Street frontage of the second storey is placed 45 feet back from the street line, thus giving a floor area of 302 by 130 feet, sufficient for the accommodation of 58 cars. This will make the total capacity of the new barn 120 cars and the total capacity of the company's barns on the block, 180 cars.

The block is naturally low lying and after investigation of the soil the engineers decided that a pile foundation was advisable for the new barn. The average length of the piles

driven is 20 feet and the building is so designed that the entire load is carried on the piles, no allowance being made for any load being carried on the soil.

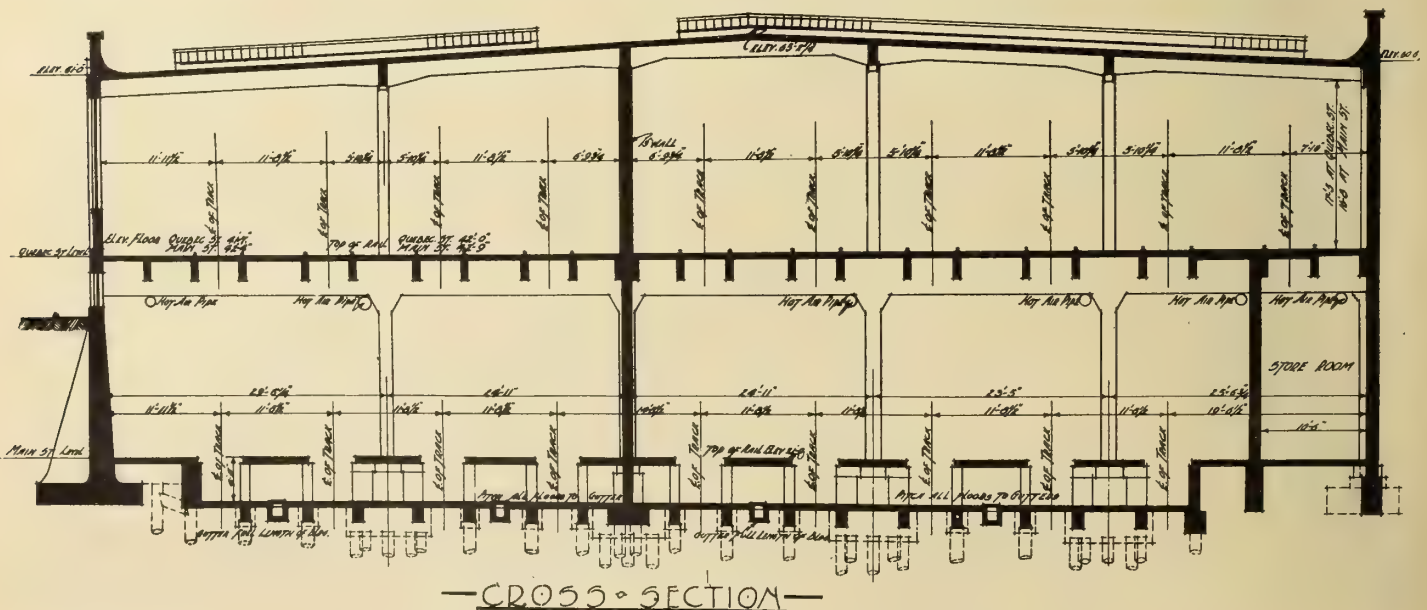
The general type of construction throughout the entire building is reinforced concrete skeleton with the exception of the columns between the first and second floors, where steel is used in order to economize floor space.

The building will be finished with 13-inch brick walls on



Interior new B.C.E.R. car barn.

the outside. In these walls will be fixed steel sash, glazed with quarter-inch wired glass and steel doors of the rolling type which are to be chain operated. Practically all the tracks on the first floor will be provided with pits for inspection purposes. The floor consists of five-inch reinforced concrete slabs between the rails, these being supported on 12-inch square concrete piers, placed at about seven feet cen-



Cross section B.C.E.R. Company's new car barn, Vancouver, B.C.





First floor plan B. C. E. R. Company's new car barn, Vancouver, B.C.

tres, extending from the pit floor. The pit floor is  $4\frac{1}{2}$  feet below the level of the barn floor and is formed of six-inch concrete with piles under each of the track pedestals and building columns. The floor is graded to drain into four channels 10 inches wide which run the whole length of the building and are covered with iron gratings.

The second floor will be used merely for storage purposes, no provision being made for inspection pits, etc. Five-inch reinforced concrete slab construction is used with reinforced concrete girders 8 by 24 ins. placed under the rails. The second storey is supported on concrete covered steel columns placed between each pair of tracks, the centres varying from 23 feet 5 inches to 29 feet  $6\frac{1}{4}$  inches and the lengthwise spacing being about 20 feet 4 inches. The cross girders between the columns are 3 feet 10 inches in depth. The roof of the building will be  $3\frac{1}{2}$ -inch reinforced concrete slab carried on cross concrete beams 18 inches in depth.

For the construction of the building it was necessary to excavate about 12,000 cubic feet of earth. The approximate amount of concrete used is 5,500 yards and the construction plans call for the use of about 400 tons of steel.

The building will be heated by an indirect heating system, oil fuel being used. This installation consists of two 70 h.p. boilers, the heating being driven through ducts running through the building, by a 130-inch fan. For the rooms set apart for the use of barn employees and street car men a direct steam heating system will be employed.

In accordance with the requirements of the fire underwriters a steel tower carrying a water tank with a capacity of 35,000 gallons will be installed above the second storey. This is connected with a sprinkler system which provides 2,450 heads throughout the building, both roof and aisle sprinklers being installed. Both floors are divided into two sections by a thirteen-inch brick fire wall.

One track on each floor will be arranged for the washing and painting of cars. On the lower floor provision is made for a room for sand drying and the storage of oil. On this floor is also located a shop for carrying out minor repair jobs, a freight elevator 5 by 8 feet in size connecting the shop with the second floor.

The cars will enter the first floor of the barn direct from Main Street. For the purpose of affording entrance to the second floor the company will construct a track from Main Street along Thirteenth Avenue and Quebec Street to the second storey entrance. The plans of the company provide for the continuation of the facade of the new barn along the entire Quebec Street frontage of the block,

It is expected that a portion of the accommodation afforded by the barns will be available by October 1st.

The new barn is designed to accommodate the cars of the company operating in the eastern section of Vancouver as well as its South Vancouver lines. For the accommodation of its cars operating in the western section of the city the company last year constructed a large car barn in the Kitsilano district.

### Stepless Storage Battery Bus

The accompanying illustration represents a type of bus manufactured by the Field Omnibus Company, New York, in co-operation with the New York Motor Bus Company. Though the bus is double-deck type it is of such low height that it will operate with safety under trolley wires and viaducts or other elevated structures. The seating capacity is thirty-eight passengers, eighteen below and twenty above.



Double deck storage battery bus.

Height, 20 ft. 10 ins. overall; distance from ground into car  $12\frac{1}{2}$  ins.; height of car roof from ground 7 ft. 8 ins. The construction is of steel. The rear wheels are mounted on an auxiliary truck which carries the driving machinery. Two 10 h.p. motors operated by an Edison storage battery equipment of 100 cells supply the motor power. The lighting of the bus is from a separate set of batteries. The motive batteries have sufficient capacity for a ten-mile speed on a 6 per cent. grade.



## The Car for Suburban Service

The growing importance of the omnibus as a means of transportation in city and suburban service is strongly evidenced by the increased demand for vehicles of this character. The bus illustrated herewith represents a type operated by the Interborough Bus Company, River Edge, N.J., and is mounted on a three-ton Hurlburt chassis having a wheel base of 13 ft. 6 in.

As the illustration shows, entrance and exit is made only

the same car builders. Except in a few details the new cars are duplicates of those built on the former order, and like them, were designed by Mr. Terrance Scullin, master mechanic of the railway company.

The principal difference between the new and old cars is in the seating arrangement. The cars built on the first order have longitudinal seats on the devilstrip side and transverse seats on the open side, whereas the new cars are fitted with longitudinal seats on both sides. This arrangement results in slightly increased seating capacity and additional aisle space. A figure showing the entrance side of the new car is reproduced herewith as also a general plan of the car. The dimensions are: track to side sill, 2 ft. 1½ in.; side sill over trolley board, 9 ft. 6 1/16 in.; floor to head lining, 8 ft.; track to well, 12 5/8 in.; well to step, 12 in.; step to floor, 7 3/8; weight of car body, including electrical equipment, 22,600 lbs.

Steel shapes and plates are employed in the bottom frame construction, the sides being of the girder type. On the devilstrip side the girder is continuous and on the open side is carried over the door way by means of angle and plate posts, which are joined at the top by 3-in. I beams, angles and plates. The frame is depressed at the centre, avoiding the necessity of a step from the street to the floor of the centre well. At each end of the well are two steps leading to the floor of the car body proper.

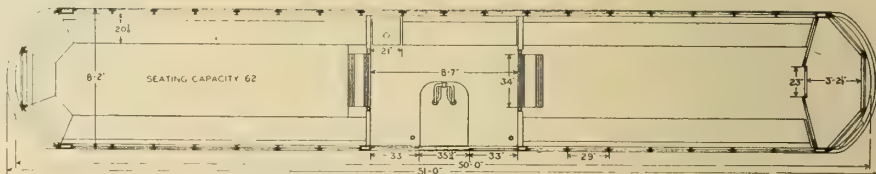
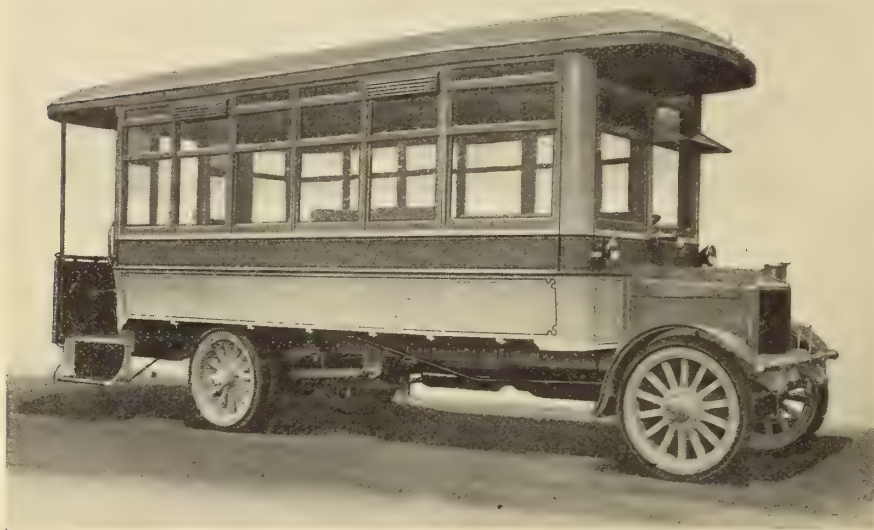
The plain arch roof is supported on steel carlines and the cars are fitted with the Scullin systems of lighting and ventilation, which are standard for the plain arch roof cars used by this railway company.

Cherry is used for the interior finish and the seats are upholstered with twill-woven rattan. As the diagram indicates, the cars are intended for single-end operation, and the rear end is provided with a curved bench. The cars are oper-

by the rear platform. The driver is enclosed in a cab on the forward left hand side of the body and has nothing to do with the collection of fares, which is looked after by the conductor. The roof of this car is of the plain arch type with double window sashes, the upper raising and the lower dropping into pockets; the sash on each side directly over the rear wheels raise. The platform at the rear is provided with a curtain which, when necessary, is drawn down to the dasher rail. A single sliding door is located in the rear bulk head. The interior is handsomely finished in ash with maple veneer ceiling. The seats are of Brill twill-woven rattan, those placed transversely having stationary backs. The driver's cab is entered through a door on the left hand side and is equipped with a comfortable leather seat. Push buttons are provided on the side posts. Yellow pine and oak are used in the under frame construction; poplar and ash in the upper frame.

The seating capacity is 22. Dimensions:—Height from ground to side sill, 3 ft. 5½ in.; side sill over roof boards, 6 ft. 11 9/16 in.; floor to headlining, 6 ft. 8 1/8 in.; roadway to first step, 16 5/16 in.; first step to second step, 13½ in.; second step to floor, 12½ in. Weight of body, 3,800 lbs.

Bus for suburban service—seating capacity 22.



Side view and plan of new Cleveland centre entrance cars.

## Centre Entrance Type Cars

A few months ago the G. C. Kuhlman Car Company built fifty centre entrance cars for the Cleveland Railway Company which were a considerable departure from the usual centre entrance type. These cars found such immediate favor with the public that a supplementary order for fifty more cars was placed and has recently been completed by

ated on the railway company's pay-enter and pay-leave system of fare collection, which has given great satisfaction in Cleveland.

It is reported in this section that work on the transmission line from London west through Delaware to Strathroy will be undertaken in the near future by the Hydro-electric Commission of Ontario.



# Illumination

## Indirect Lighting of Stores

The illustration herewith reproduces the showrooms of the Toronto Hydro-Electric System illuminated by Alexalite units. In this fixture, the electric bulb is concealed in a powerful glass enamelled steel reflector. This reflecting shield is basin-shaped and its inside formed with a plurality of concentric corrugations, producing annular reflectors with surfaces on different planes. By this means the light is reflected from one side to the other of the reflector, and it issues at the top in a greatly diffused condition, striking the ceiling and making an area of illumination larger than the diameter of the reflector, the rays of light falling nearly vertically to the working plane. The reflector has the enamel hard fired on, interior surface glazed, and the exterior dull

mat finish to conform as nearly as possible in color to the ordinary plaster ceiling. Mechanical injury to the fitting is practically impossible. It is easily cleaned by the unhooking of one chain, allowing the reflector to hang by the remaining two; dust with an ordinary dust-cloth, and replace chain in position.

These fixtures are manufactured to have the upper edge of the reflector hang 18 ins. from the ceiling, and do not require any adjustment when installing. The amount of light obtained depends upon the size of lamp used. This unit is claimed to be specially adapted for use with the new nitrogen filled lamp, the lamp hanging perfectly free from any obstruction to the surrounding atmosphere. This new system, although only perfected recently, has already acquired



The illumination of a large display room with indirect units



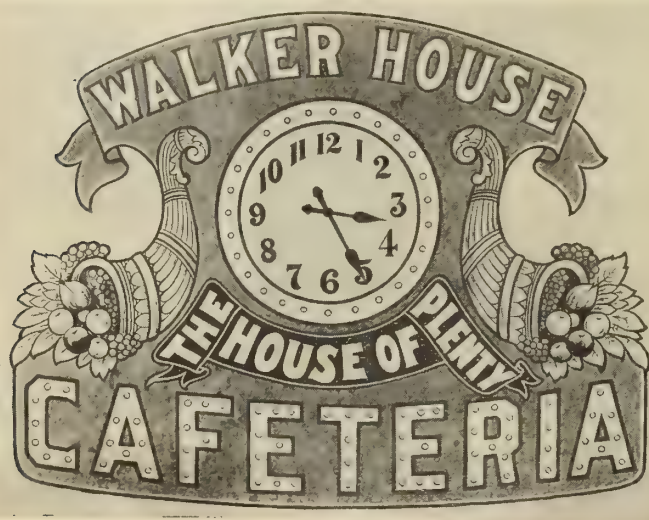
great popularity with the heads of commercial institutions, who find that, by using it in banks, counting-rooms and similar places, where a large number of employees are necessary and much clerical work must be performed under artificial light, they effect an appreciable saving of the employees' nervous energies, which may be better applied to the employer's advantage. Hospital physicians often recommend this means of illumination also for much the same reason, that it reduces the amount of nervous strain to which patients are subjected. From an eye specialist's standpoint the ideal lighting is that which illuminates the object seen, with an even intensity of light at all points. That is the reason for the feeling of restfulness claimed to be experienced when reading under the Alexalite—simply because there is no struggle going on within the eye to shut out the glare. The light is even, and the muscles of the eye are as much at rest as when working under daylight. The best daylight, undoubtedly, is on a bright day when the sun is obscured by a cloud. This is natural, indirect daylight, serviceable for all purposes excepting where a great intensity of light is required. This is the principle on which it is claimed the patent Alexalite was devised after lengthy experiments. Ideal lighting means just this—seeing without strain, distinguishing in true relation, and preserving the eyesight not only from fatigue but also from permanent injury. This can only be accomplished in one way—by removing all spots of light from the normal range of vision, and in such a way that the eye is effectually screened from the actual source of light. But further still, it means doing this in a practical way that will meet all general conditions; so it can be used commercially, possessing, in addition to the above requirements, the undoubted advantage of high efficiency, low maintenance and absolute uniformity.

The approximate height of the ceiling in this instance is 17 ft. Each fixture contains one 500 watt nitrogen filled lamp installed every 20 ft. The centre outlets previously used with other lighting fixtures is found not to be necessary in this case, as more light and much better light is obtained in the present system. This unit is adaptable for any height of ceiling up to 40 ft. The approximate candle power on the working plane in this installation is 10 or 12-foot candles. The illustration shows that ample and very even illumination is provided for all the articles on display.

This installation was designed and put in place by the James Devonshire, Limited, Canadian agents for the Alexalite Company.

### A Handsome and Attracting Sign

A handsome sign has just been erected for the Walker House, Toronto, facing on Front Street, which is one of the



most attractive in the city. This is of an original design planned and built by the Denis Advertising Signs, Limited. The sign is double faced, the colors on each side being illuminated from within. The centre of the sign is occupied by a large secondary clock, operated electrically from a master clock located elsewhere in the building; this clock has a three-foot illuminated dial, and is surrounded with a circle of lights as shown. The outside dimensions of the sign are: length, 10 ft. 6 ins.; height, 8 ft. 4 ins.; 250 lights are used. The word "Cafeteria" at the bottom of the sign is composed of 16-in. letters illuminated with individual lamps and outlined with a patent gold flange to make them stand out more prominently. The colors of the sign are a green background surmounted by a proportionate admixture of blue, red and yellow.

### Storage Battery Factory for St. Johns, P. Q.

Coincident with the "made in Canada" policy which is now finding so much public favour, it is satisfactory to record the establishment in this country of a new branch of the electrical industry. The Canadian Hart Accumulator Company, Limited, has been formed to develop here a business which is now carried on in Great Britain, where the parent concern manufacture batteries which are sent to all parts of the world. With British capital, the company are constructing at St. Johns, P.Q., a large storage battery factory. The building is of brick and steel, and will be ready in about six weeks. The company will manufacture a complete range of sulphuric acid batteries and all types of plates on the same principles as the batteries made in Great Britain. The list includes the Plante type, the Hart demi-plante, and the various pasted types. It is proposed to make batteries for electrical vehicles, isolated plants such as used in country houses, for central station and tramway loads, train lighting, and starting and lighting for automobiles, launches, and motor boats. Mr. C. W. Knighton is the Canadian manager.

### Personal

Mr. Edward A. Hanson, city electrical engineer, Saskatoon, Sask., has been elected to membership in the Institution of Municipal Engineers, Great Britain.

Mr. Truman P. Gaylord has been elected acting vice-president of the Westinghouse Electric & Manufacturing Company, succeeding Mr. H. D. Shute. Mr. Gaylord was formerly district manager of the company at Chicago.

Mr. Henry D. Shute has been elected treasurer of the Westinghouse Electric and Manufacturing Company succeeding Mr. T. W. Siemon recently resigned to accept the position of secretary-treasurer of the Union Switch & Signal Company.

With the closing of the tie-line switch at San Bernardino, Cal., on August 13, energy was transmitted from Bishop Creek to El Centro, Cal., a distance of 400 miles, completing what is probably the longest transmission circuit in the world.

In view of the fact that the European war has eliminated several sources of permanent magnets required in the electrical industry, the announcement made by the Esterline Company of Indianapolis, Ind., is important. This company announce that they are prepared to furnish on short notice permanent magnets of the highest quality of workmanship and electrical characteristics. They have a very complete magnet manufacturing department, which has been used for the manufacture of permanent magnets for electric lighting generators for automobiles, for tachometer generators and permanent magnets for graphic instruments,



# The Dealer and Contractor

## Flush and Baseboard Receptacles

The increasing demand for the flush receptacle, in both office buildings and private residences, has suggested the usefulness to electrical contractors and others less closely in touch with recent developments, of a short article outlining the various types at present on the market. No attempt at comparison is made, as the value of each type of receptacle depends on a number of elements, not the least of which is the particular requirement of the individual installation, as well as individual taste. The dependable and lasting qualities of the various types, as well as their factors of safety in operation, can be best determined by experience. It seems almost unnecessary to outline even briefly the usefulness of the baseboard receptacle. In the office—for the fan, small heater, table or portable lamp; in the home—for the fan, heater, bed warmer, curling tongs, flat iron, small vacuum cleaner, water heater, toaster, and all the other household appliances; rendered all the more attractive by the low rates now being given by many companies and municipalities. It is safe to say that no other small device is capable of adding so much to the convenience and comfort of every-day life, as is the flush receptacle, and when this comes to be appreciated by the general public, their use will become many times more general. Indeed, it is not too much to expect that in the very near future, no home or public building will be considered complete without them.

In this connection too, it is well to consider the effect the installation of flush receptacles will have on increasing the use of electrical appliances. They will have the effect of creating a demand for electric current, and so should be encouraged by the central station quite as much as by the electrical contractor. The time is fast approaching when electrical appliances, which now seem luxuries, will have become necessities, when gas will have given place to the electric

at least, supplementary heating, the electrical contractor will fail in his duty, if he leaves any stone unturned to remedy this omission. The chief obstacle in the way, of course, is the untutored householder, who is unable to appreciate the advantages he has not yet experienced. The campaign of education is making good progress, however, and, without question, a big field is looming up for the electrical contractor.

The following brief references to the various figures will explain in part the characteristic features of the receptacles produced by the different manufacturers.

Fig. 1 represents the Hart & Hegeman type of flush receptacle. In this unit there are no doors to pry open, no guiding pin, no screw thread. The plug fingers fit neatly into the apertures of the face plate, and, when withdrawn, leave a very neat appearing surface.

Fig. 2 represents Machen & Mayer's screw plug type. When the plug is withdrawn, the door fits neatly over the opening, rendering it practically dustproof.

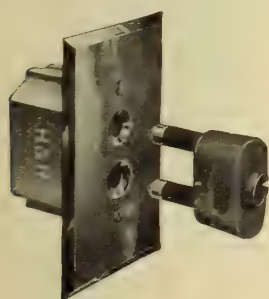


Fig. 1

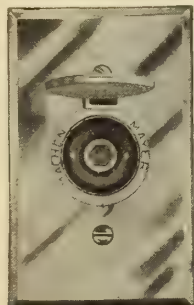


Fig. 2

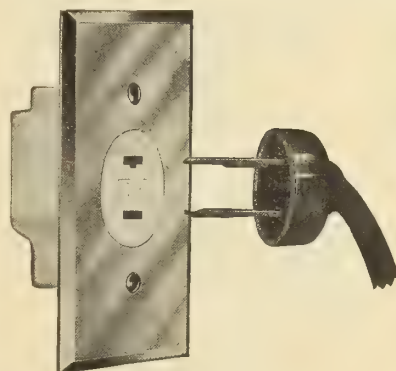


Fig. 3

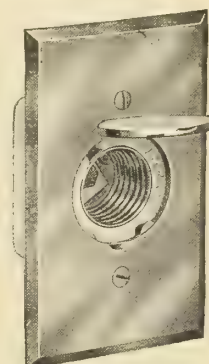


Fig. 4

Fig. 3 is another type of Machen & Mayer's plug of the simple push construction. The porcelain face plate adds to the insulating properties of the plug.

Fig. 4 is one of the Bryant types of receptacle. The advantage of this kind of receptacle is that a plug may be transferred from an electrolier or bracket and screwed into the base receptacle. When the plug is withdrawn, the door closes to keep the dust and moisture out.

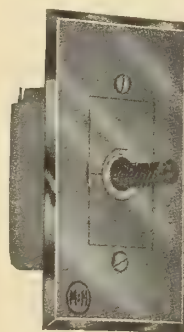


Fig. 5



Fig. 6



Fig. 7

range, and when the electric heater will have become the recognized early fall and late spring supply of warmth.

This opens up another question—that of the size of the leading wires. The householder will be well advised in making ample allowance for future development in this direction. All these things must be explained by the electrical contractor and, if necessary, insisted upon. If the houses building to-day are not wired with sufficient capacity to take care of,



Fig. 5 shows the Machen & Mayer plug type with plug inserted.

Fig. 6 represents what is known as the Bryant "Junior" flush receptacle.

Fig. 7 is the Bryant disappearing door receptacle. The doors open and close automatically with the insertion and withdrawal of the plug. This makes this receptacle suitable for floor as well as baseboard use, as dirt and dust cannot enter it. It is also a very safe receptacle, as, when the plug is withdrawn, the doors are shut tight by stiff springs, so that it is almost impossible to gain access to the live parts.



Fig. 8



Fig. 9

Fig. 8 represents the Chapman type of plug manufactured by the Cheltenham Electric Company, Philadelphia, Pa. The doors fit neatly over the plug, giving a smooth and very neat appearance.

Fig. 9 is the Edison screw type also manufactured by the Cheltenham Electric Company. This will take any standard screw plug. The plates are dustproof, well finished, and neatly hinged and fitted.



Fig. 10

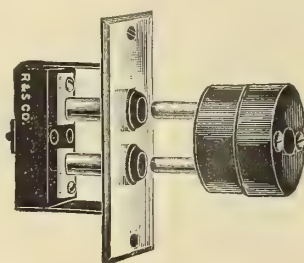


Fig. 11

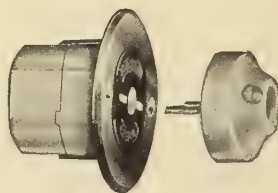


Fig. 12

Fig. 10 represents what is known as the Cheltenham Composite Type receptacle.

Fig. 11 is a very neat receptacle, manufactured by the Russell & Stoll Company, New York. This fitting is particularly adapted for vacuum cleaners and heating appliances, or wherever current consumption is greater than the ordinary receptacle is adapted to carry. The plug is non-reversible.

Fig. 12 is a flush receptacle of the universal type, manufactured by the Duncan Manufacturing Company, of Montreal. This is a very neat appearing plug.

Fig. 13 is another type of Duncan flush receptacle, which takes the same plug as Fig. 12, and is also made to fit standard metal boxes.

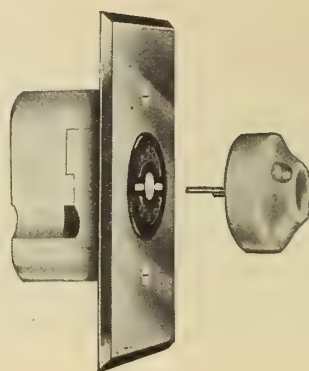


Fig. 13

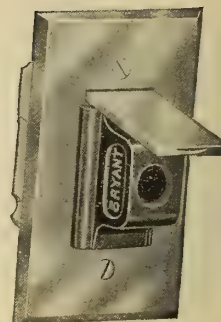


Fig. 14

Fig. 14 is another form of Bryant receptacle, known as the Old Style Chapman.

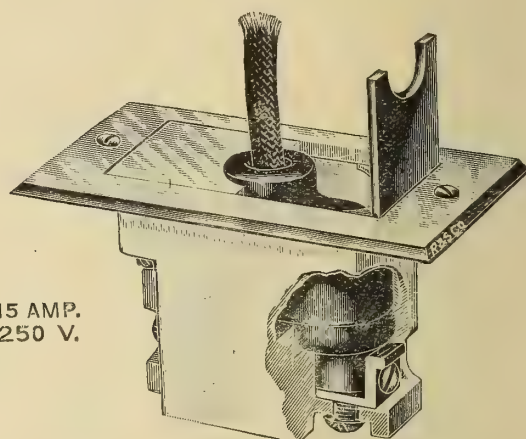


Fig. 15

Fig. 15 is another type of receptacle manufactured by Russell & Stoll. This consists of a heavy porcelain receptacle, taking a heavy composition plug, which is entirely flush with the plate when in use.

Fig. 16 is one of the types manufactured by Harvey Hubbell, Inc., Bridgeport, Conn. This represents a new line with a small cap.

Fig. 17 is another type of receptacle manufactured by Russell & Stoll. The body of the receptacle and the plug are made of heavy porcelain mounted in a cast iron box with a brass plate.



Fig. 16



Fig. 17

Fig. 18 represents another type of Hubbell receptacle, very similar to Fig. 16.

Fig. 19 is another form of the Chapman receptacle, manufactured by the Bryant Electric Company. Fig. 28 represents a plug withdrawn.

Fig. 20 is a high capacity, disappearing door receptacle of the Bryant type. This has a capacity suitable for heaters, moving picture machines and other portable current con-





Fig. 18

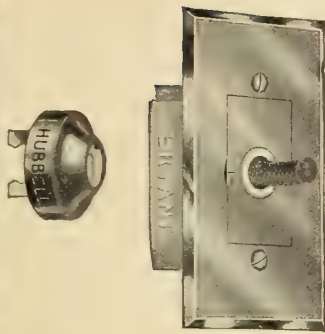


Fig. 19

suming apparatus requiring a large amount of current. The design is the same as that shown in Fig. 7.

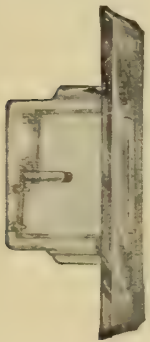


Fig. 20



Fig. 21

Fig. 21 is a screw plug type manufactured by the Harvey Hubbell, Inc. When the plug is removed the door fits down snugly, so as to present a flush surface.



Fig. 22



Fig. 23



Fig. 24

Fig. 22 is another form of Hubbell receptacle and plug for three-wire supply. The plug is so designed that it cannot be wrongly inserted.

Fig. 23 illustrates a Canadian General Electric receptacle, made to take any standard Edison screw attachment plug. This is furnished complete with a cast face plate, and in the design of the mechanism attention has been paid to making the connecting posts as accessible as possible, permitting a maximum saving in time and wiring.



Fig. 25



Fig. 26

Fig. 24 is one of an extensive line of separable devices, all interchangeable, manufactured by the Canadian General Electric Company. The design of the contact fingers in all these devices is unique, and makes for an unusually reliable connection.

Fig. 25 is still another form of Hubbell receptacle. This is known as a polarity type, with knife-blade contacts set at right angles. This type is designed for use where it is desirable or essential not to change the polarity.

Fig. 26 is a circular type of flush plug, also of the Hubbell manufacture.

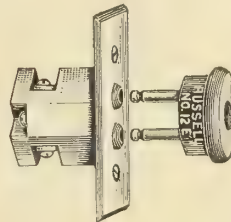


Fig. 27



Fig. 28



Fig. 29

Fig. 27 is an extra heavy type of plug, made by Russell & Stoll. The body is of heavy porcelain and the plug of extra strong moulded composition.

Fig. 28 represents the plug used in connection with the Bryant receptacle shown in Fig. 19.

Fig. 29 represents another type of flush receptacle manufactured by the Bryant Electric Company.

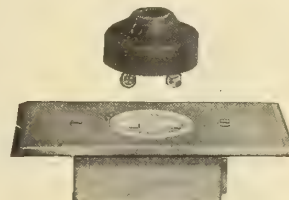


Fig. 30



Fig. 31

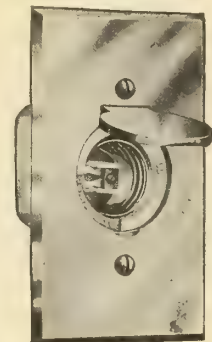


Fig. 32

Fig. 30 illustrates the larger type Cutler-Hammer design of baseboard receptacle handled in Canada by the Benjamin Electric Manufacturing Company.

Fig. 31 is a smaller type of Cutler-Hammer design.

Fig. 32 is a screw type receptacle manufactured by the Trumbull Electric Manufacturing Company. When the plug is removed the door fits down neatly, making the receptacle dust and water proof.

### Trade Enquiries

Name and address of inquirer may be obtained on application to the Electrical News, Toronto.

887. **Engines and boilers.**—A firm in Johannesburg with branches throughout the Transvaal, Free State and Natal, desires to receive catalogues, quotations and full particulars from Canadian manufacturers of small portable engines and vertical boilers, in capacities of 2, 4, 6 and 8 h.p., suitable for small irrigation plants and general farm purposes. Quotations preferred f.o.b. Montreal and St. John.

The operation returns of the municipal street railway, Regina, for the week ending August 15th are as follows: revenue \$3,230.05; passengers carried, 79,998. For the week ending August 22 corresponding figures were \$3,779 and 86,933.



### New designs in Busbar Supports

The following description, by the General Devices & Fittings Company, Chicago, of new designs of busbar supports and special porcelain recently placed on the market by that company, is of interest.

"The first and most important feature of the bus bar supports is the design of the porcelain part. In designing this part great care was taken to produce an even distribution of stresses and strains over and throughout the porcelain parts. The voltage requirements for safety factor and the results of flash over and arc over tests were given great consideration. It is well known that a certain piece of porcelain will arc over before puncture. It is not generally known, however, that cases exist where this particular piece of porcelain should puncture before flashing over.

"With the new high frequency testing equipment we are able to absolutely determine where a piece of porcelain should be reinforced or the dielectric decreased. This means that some porcelain should be reinforced at the voltage point and weakened at the ground point, and other porcelain of similar nature should be reinforced at both points. These points were discovered through the aid of high frequency and we can state unreservedly that we believe this one feature is without doubt the greatest advance that porcelain design has received in years.

"Many tests and careful investigation of the use of ce-

certain plants have shown, by careful test, that they are subject to a magnetic pull as high as 455 pounds per lineal foot of bus. It is therefore obvious that proper bus supports should be specified to take care of these situations, knowing that this magnetic pull will be increased tremendously through a short circuit, motorizing, inductive troubles, etc. Many of our larger plants are trying to reduce this liability by the use of reactances, which are furnished for generator, bus bar and feeder service. The generators can be wound with a pre-arranged percentage of reactance and have also an outside reactance as well. When we consider the enormous strain that is placed on bus structures through short circuits we naturally inquire where the strain comes from. The ratio of full load to short circuit on turbine driven generators without reactances would in no case be less than three times and might be as high as fifteen times, depending upon the size of the unit and its regulation. With these facts before them engineers are now taking great pains with their bus bar equipment, and especially the supports for the same.

Referring to the cuts attached to this article, Fig. 1 shows a bus bar support for 22,000 volts with a guaranteed test, all assembled, of 112,000 volts. This support carries a ceramic factor of 1.29, which is over 60 per cent. greater than any support on the market. This support is set on an insert which was designed to be molded into the concrete floor of

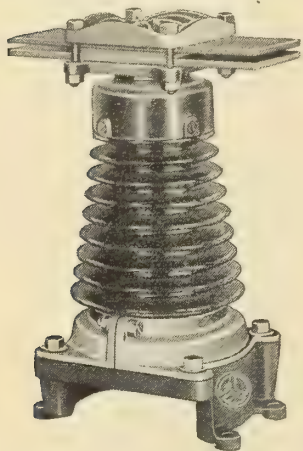


Fig. 1.

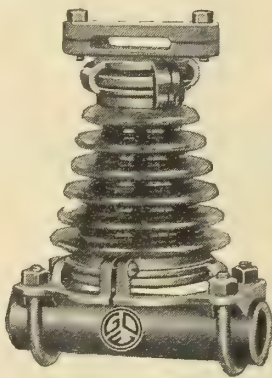


Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.



Fig. 6.

ment in any form with porcelain has led us to adopt mechanical cushioned clamps throughout our entire line. The dielectric change in porcelain due to the use of cement is understood to-day as being one of the factors that causes aging and fatiguing of porcelain carrying large currents, and this is the subject of a world-wide ceramic study of the best engineers. This company is offering a product in porcelain entirely different from anything on the market.

"Our patented pyramid type porcelain bus supports are designed with small thin corrugations beginning at the voltage point and tapering wider and deeper to the ground point primarily to reduce the electrostatic field. This patented feature was brought out after a long series of tests and investigations to the end that a product could be produced that would give long life with the highest possible maximum of safety and the least minimum of expense.

"Engineers are aware of the cost of up-keep and maintenance of porcelain now installed through constant replacement and renewals. We could cite innumerable cases of complete shutdowns and outages due to porcelain entirely. We offer a safety factor of  $4\frac{1}{2}$  to 12 times, depending upon the service voltage impressed on the porcelain part; the larger the kilowatt capacity being supported the greater should be the safety factor and the more rigid the support to take care of this feature.

"It is interesting to note that bus bar equipments in

compartments. This is one of this company's patented features and is original with us. All hardware, excepting the insert itself, is made of hard bronze. This bus bar support will hold a strain exceeding 1,200 pounds per square inch. The cut shows two laminations of  $\frac{1}{4}$ -in. bus bars with one filler. These supports are designed to hold any size or capacity of bus bar.

Fig. 2 shows a standard bus bar support equipped for holding flat buses on the horizontal and for mounting on pipe frame, this support having two "U" bolts.

Fig. 3 shows a bus bar support for supporting buses in vertical position and for mounting on pipe frame. This pipe frame support has a set screw in the lower clamp to prevent the support from turning on the pipe and is used where supports like Fig. 2 are too wide for close work.

Fig. 4 shows a bus bar support for mounting buses in a vertical position with a flat base and centre bolt clamping arrangement. It is a very popular support for medium-sized bus bar equipments. It can be slipped over a bolt which has been imbedded in the concrete structure and turned in any position.

Fig. 5 shows a bus bar support carrying a round bus of any description. It is shown with a skeleton type base for mounting on flat surface. This base is very popular and much in demand.

Fig. 6 shows a bus bar support for holding large insu-



lated cables or bare cables as the case may be, and is shown with a compartment type base. This enclosed base is hollow in the bottom and drops over a stud, which may be cemented in the compartment floor, and is much in demand where height is limited.

All the above supports can be furnished with any of the bottoms or any of the tops, to suit conditions. Fig. 1 support can be furnished either as a double support, three-way or four-way support, and arranged to carry buses on the vertical, on the horizontal, or special tubular buses, and all supports can be adjusted to any angle by simply unloosening clamps.

### The Compensarc for Moving Picture Machines

One of the most difficult problems connected with the moving picture business is the management of the light for the machine. This not only determines the amount of one of the largest items of expense but also influences the popularity of the show. A theatre will not be patronized unless it supplies good pictures and since the quality of the pictures depends upon the light as much as upon the film itself it is necessary to secure a perfect light at a minimum cost.

Moving picture lamps require only about 35 to 60 volts at the arc, while most commercial lighting circuits supply a voltage of either 110 or 220 volts. Some device must of necessity, therefore, be used between the line and the lamp



The Compensarc

to take care of this difference in voltage. Formerly iron-wire or grid resistance rheostats were used. Their use, however, resulted in an actual waste of all the energy supplied from the line over and above that required by the lamp. They also generated so much heat that they not only made the operating room like an oven, but were liable to set fire to the films or other inflammable material.

A device called a compensarc, supplied by the Canadian General Electric Company is claimed to overcome these difficulties by reducing the current without needless waste or generation of heat. There are two kinds of compensarcs—one for alternating current only and one for direct-current only. They are entirely different in construction and operation, but their purpose is identical and they produce practically the same results. The alternating current compensarc is rated at 2 kw. for 110 volts or  $2\frac{1}{2}$  kw. for 220 volts and

wound for either 60 cycles or 133 cycles, as may be desired. Its general appearance is clearly shown in the illustration. The core is made of the highest grade sheet steel laminations, similar to standard transformer construction. The outer surface of the core is fully exposed to the air. The coils are mounted within the core and are completely protected and thoroughly insulated. Core and coils are given vacuum treatment, making them moisture and waterproof. A horizontal, three-step, continuous circuit switch is mounted on the slate top, providing three adjustments for intensity of light. Each adjustment is so designed that it maintains approximately the same voltage at the arc while passing from one step to the next, without at any time opening the circuit which would consequently break the arc and produce flickering.

The compensarc is claimed to be the only device which is adjustable without breaking the circuit between adjustments. There is no waiting for the arc to settle and become steady before the intensity of the light can be determined. It increases or decreases the intensity of light without a flicker. In actual operation it has been found to effect a saving of one-half to two-thirds of the operating expenses and at the same time produces a much better light for the picture.

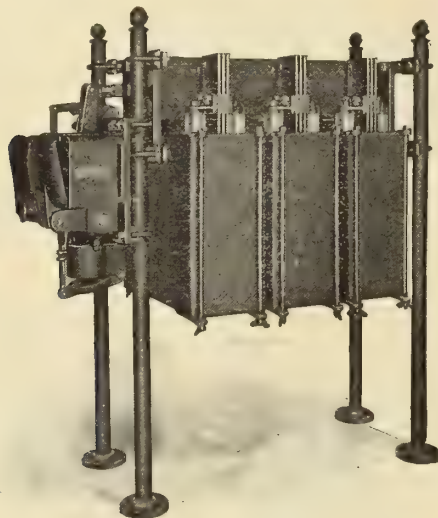
### Condit Type "Y" Oil Circuit Breaker

Owing to the unsatisfactory operation, due to the excessive burning of the contacts and the enormous rise of potential at the instant of opening, on carbon-break circuit breakers of large current-carrying capacities on alternating-current circuits, there has been a demand for an oil-break circuit breaker for such service. The Condit Electrical Manufacturing Company offers such an oil circuit breaker in its type "Y." The illustration shows a 2,000 ampere, 3-pole, electrically-operated, Condit type "Y" oil circuit breaker. This type of breaker is also made in capacities up to 6,000 amperes and 3,300 volts.

The stationary current-carrying parts of the Condit type "Y" oil circuit breaker consist of laminated copper bars, securely fastened to wet-process porcelain insulators and carrying on the lower ends of the bars heavy, massive copper blocks on which contact is made. The upper ends of the laminated bars extend through the switch frame and form the laminated terminals to which the conductors are fastened, this type of terminal construction being standard, although when necessary the terminals may be arranged for cable connection. The moving contacts consist of the standard Condit laminated brush which in its closed position spans the space between the stationary contacts. The brush is made in two parts, each part bearing on the stationary contacts. Owing to this method of construction, the strain on the porcelain insulator is equalized and, furthermore, the arc is divided into four parts in each oil tank, or eight parts per phase, thus materially increasing the current-rupturing qualities of the circuit breaker. The brush is so mounted on its supports that it is self-adjusting in position on the stationary contacts. Each brush is composed of a number of laminations so arranged that each lamination makes individual contact, but is also separated from the adjacent laminations by a space at the point of contact. This space allows for free circulation of oil between the brush laminations and also permits the brush to be made with a steep angle of contact, thus giving a long, wiping, inherently self-cleaning action in contradistinction to the dead action of the ordinary "butt on" brush. While this brush is capable of successfully opening considerable energy without injury, the construction of the apparatus is such that the brush is not required to perform any other function than that of carrying the current. All arcing, in either making or breaking the circuit, is taken care of



by heavy auxiliary contacts of special non-arcing metal, which make contact before and break contact after the laminated brush has left the stationary contacts. The brushes are mechanically connected to, but electrically insulated from, the operating mechanism, by strong, impregnated wooden rods. The arc is broken near the bottom of the oil tank, and, consequently, under a high head of oil. It is well known that when an arc is formed in oil it is vaporized at an extremely high temperature. The gases which are formed, due to this vaporization, are forced to travel upward through this high head of oil and in so doing are greatly cooled, thus reducing to a minimum the danger of an explosion in the gas dome over the oil line. The safe operation of this breaker is further increased by the introduction of a deflector plate, so de-



Large capacity circuit breaker

signed as to prevent the throwing of oil from the oil tanks when the arc is broken, while at the same time no opposition is afforded to the free movement of the gases of vaporization.

The oil tanks in this breaker are also of noteworthy construction. In many cases the oil-containing vessels of a switch are its weakest point, and many disastrous failures may be traced to the destruction of the oil tanks. The oil tanks on this breaker are exceptionally strong. They are rectangular in shape and are made of heavy 3/16-in. thick, electrically-welded sheet metal, absolutely without joints and equally strong in all parts. The tanks are lined with an especially prepared insulating material.

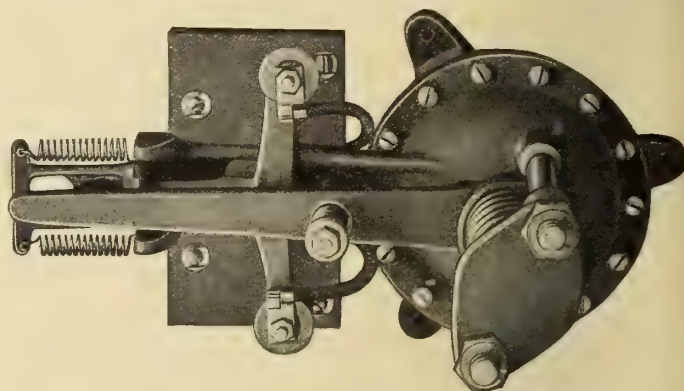
The operating mechanism is simple, strong and rugged, and so designed that the maximum closing force is applied at the contacts, with the minimum expenditure of energy at the operating handle. In the hand-operated type, the circuit breaker is operated by a simple in-and-out movement of the handle. The stationary contacts are mechanically supported by, but electrically insulated from, the main frame by porcelain bushings which in turn are fastened to the main frame by means of clamps, without the use of any babbitt or cement. Such a construction tends to simplicity and ease of assembly and adjustment, or removal in case repairs are necessary. The porcelain bushings used are all in one piece and of wet process porcelain. Wet process porcelain will stand a higher puncture test than any other type of porcelain.

These breakers are furnished either hand or electrically operated. In the latter case, electro-magnets are employed for operation. The operating magnets may be placed above, below, or in the rear of the circuit breaker, the particular location depending entirely upon the local conditions incident to the installation of the apparatus. The breaker is designed for pipe-frame mounting in both the hand and electrically-

operated types, and is designed to carry its rated current with a temperature rise not exceeding 30 deg. C.

#### New Double Pole Pressure Regulator for Starting and Stopping Small Motors

The double pole diaphragm type pressure regulator illustrated below is a new device for automatically controlling small direct or alternating current motors operating on pressure systems. This regulator stops the motor when the maximum pressure desired is reached and starts it again when the pressure drops to the low value for which it is set. For

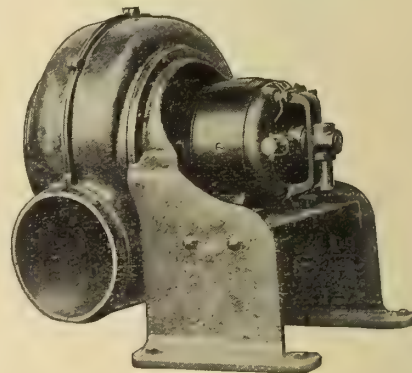


Double pole pressure regulator

capacities within the limits for which it is designed (1 h.p. for d.c. and 5 h.p. for a.c. motors) this regulator controls the operation of the motor without an additional magnetic switch and automatically maintains pressure in the systems between given limits. It is made by The Cutler-Hammer Manufacturing Company, of Milwaukee.

#### A New Line of Small Ventilating Outfits

The Westinghouse Electric & Manufacturing Company announce that they have placed on the market a new line of small ventilating outfits for use in moving picture theatres, restaurants, hotels, bakeries, laundries, stores, offices, public buildings, etc. The line includes two types—Ventura fans and Sirocco blowers. The Ventura fan is suitable for mounting in the wall and handling large amounts of free air. The fan differs from the ordinary type in having a larger number of blades which are mounted on a large central disk and have the ends abruptly turned up. This form, it is claimed



Sirocco ventilating blower

by the manufacturer, operates very quietly and with high efficiency. The air is thrown from directly in front of the fan, instead of being widely spread out, and no back flow is possible through the centre of the fan. The unit is especially compact and the motor protrudes very little into the room. Great pains have been taken to make the finish attractive. The motor is a special type, wholly enclosed and



with a thrust bearing. It has ample overhead capacity to drive the fan with a strong back-pressure of wind against it.

Sirocco blowers are designed for use with systems of piping or where some resistance is offered to the passage of the air. They are used for ventilating inside or underground rooms, bank vaults, cabins and engine rooms of steamers and yachts, lavatories, telephone booths, etc. They are also adapted for many blowing operations, such as for air baths, aspiration, removing chips, and so forth. The essential parts are the motor, a sirocco blower wheel mounted on the motor shaft, a cast-iron housing to direct the air current, and a supporting base. The blower wheel is a distinctive feature. It has from 36 to 64 narrow blades and an unusually large air outlet, which reduces eddy currents to a minimum. Air is discharged at an unusually high velocity. The blower housing can be revolved and reversed so as to direct the discharge horizontally to either side or vertically up or down. A screw driver is the only tool needed to make the adjustments.

### Wireless Receptacles

Paiste wireless plug-receptacle and W. P. lamp-receptacle are now being manufactured for use in pipe taplets. No tap wires are required, the main wires being bared for half an inch and fastened directly to the binding screws of the fittings. There is plenty of room under the base for a third wire. The base is the same for both the plug and lamp receptacles, so the caps can be interchanged without taking the base from the taplets. In the lamp receptacle, the screw shell and the



Fig. 1.



Fig. 2.



Fig. 3.

Fig. 1.—Pipe taplet cut away showing wiring of base of wireless plug and W.P. lamp receptacles. Fig. 2.—Wireless plug receptacle No. 4254 on type "C" pipe taplet. Fig. 3.—Wireless lamp receptacle No. 4251.

contact button are both fastened to the cap instead of to the base. This gives a very rigid receptacle as the cap is screwed directly to the pipe taplet. As both  $\frac{1}{2}$  and  $\frac{3}{4}$  in. taplets have the same size opening only one size of receptacle is needed for both sizes of conduit. For waterproof work a rubber gasket is furnished for the screw shell receptacle, and as the base of the receptacle is sealed it is waterproof in every respect. The Hart & Hegeman Manufacturing Company, Hartford, Conn., are now sole selling agents for Paiste material.

### Dominion Bridge Gets Orders

The municipality of the city of Winnipeg have awarded the contract to the Dominion Bridge Company for steel for their special towers on their new transmission line. These towers are for special river and railway crossings, which part of the work it is the intention of the city to complete at once. The footings, both steel and concrete, are more than half completed for the new line, but the bulk of the towers, which will be of flexible design, will not be ordered this year.

Pass & Seymour, Inc., announce that they have prepared complete Spanish and Portuguese literature describing their products. This is in view of the change taking place all over America in trade conditions. The Pass & Seymour Company

is showing itself aggressively alive to the value of the South American trade. We understand that other companies are following a very similar course.

The Nineteenth Annual Convention of the International Association of Municipal Electricians will be held in Atlantic City, N.J., September 15th to 18th. Space will be provided for those wishing to exhibit electrical material and devices. Important papers will be presented covering subjects of interest to municipal electricians and those interested in electrical affairs.

The Trumbull Electric Manufacturing Company, Plainville, Conn., announce that they are now manufacturing armoured cable, flexible conduit and armoured flexible cord. This material will be high-grade in every particular. The Trumbull Electric Company purchased the machinery and patent rights from a former manufacturer and will manufacture the above in their own factory under improved conditions.

### Trade Publications

**Circuit Breakers**—A folder issued by the Transmission Engineering Company, of Pittsburgh, Pa., describing and illustrating their weatherproof oil circuit breakers for 2,500 volts.

**The Electrical Apparatus Company, Limited, London, England,** have issued the following publications.—Leaflet H 16, describing and illustrating their standard type direct-current motor starters; leaflet H 42, describing auto-transformer starters of the drum type; leaflet H 47, giving dimensions and shipping particulars of their air-brake and auto starters; and publication No. X, describing E.A.C. high torque meters for house service.

**Patents, Designs, and Trade Marks**—A booklet specially prepared for the guidance of inventors and manufacturers making application for patents, etc., by Stanley Lightfoot, registered patent solicitor and attorney, Toronto, and Washington, D.C. This booklet is written in a clear and concise manner, is well arranged for easy reference and explains in simple language many important points which are often confusing to the inventor.

**Canadian Westinghouse**—The Canadian Westinghouse Company, Hamilton, Ont., are distributing the following publications:—Cooking Breakfast at the Table, a one act true-to-life sketch describing the wonderful conveniences and labor-saving qualities of the electric toaster stove and percolator; Westinghouse Wicker Type Electric Linotype Pots; Motor Driven Pumps; Type T Direct Current Turbo Generator; and Storage Battery Locomotives.

**Canadian General Electric Publications**—Exide Battery for Electric Vehicles, bulletin section X, describing Electric Storage Battery Company's batteries for electric vehicles; Accumulators, bulletin section A, describing Electric Storage Battery Company's Chloride and Tudor accumulators for electric railway service, central lighting and power plants, isolated light and power plants, interlocking switch and signal service, telephone, telegraph, fire alarm, laboratory and small motor work; Railway Condulets, describing different types; Crane and Hoist Motors, describing commutating pole, direct-current crane and hoist types; Labor-Saving H. & H. Wall Cases; Electrocurl, describing a self-heating electric curling iron; Eveready Portable Lights, giving description and prices of Eveready mazda lamps and Eveready tungsten batteries, made to work together; Xceladuct and Orpenite Conduits, giving description and prices of copper plated galvanized and enamelled conduits. These publications are all very thoroughly illustrated.



# Current News and Notes

## Campbellford, Ont.

The Northumberland Pulp Company have placed an order with the Boving Company of Canada for two additional hydraulic presses.

## Fort William, Ont.

The net earnings for the first eight months of the present year of the Kaministiquia Power Company are announced as \$185,295, with a surplus for the same period of \$126,479.

## Montreal, P.Q.

Consequent upon the difficulty of securing funds, the Montreal Board of Control have decided to postpone the scheme of street lighting for St. Catherine Street, plans for which were prepared by Mr. Parent, the civic superintendent of lighting. The Board also decided not to award contracts for the new fire alarm system, the wires for which were to have been placed in the conduits.

## Newmarket, Ont.

Mr. F. A. Gaby, chief engineer of the Hydro-electric Power Commission of Ontario, recently addressed a meeting of about 500 interested ratepayers in Newmarket. Mr. Gaby explained the advantages of hydro service and the great possibilities of the radial lines proposed to be installed by his commission. Apparently the hydro radial scheme is being endorsed enthusiastically all through this district.

## Peterborough, Ont.

Street railway extensions planned by the Radial Railway Company are being held up temporarily, pending paving operations, which have also been postponed by the city.

It is understood that the order to expropriate the Peterborough Light & Power Company, which the city of Peterborough has asked for, has been signed. The city will pay the company the sum of \$100,000.

## Port Arthur, Ont.

Messrs. J. J. Hackney, commissioner for the city of Port Arthur, and A. McNaughton, superintendent of light, power and railways for the city of Fort William, have been appointed a committee to consider the advisability of increasing the rate of ordinary tickets of the street railway system from six for twenty-five cents to five cents straight. This would not interfere with children's or working men's tickets, and, it is calculated, would result in a 20 per cent. increase in revenue.

## Regina, Sask.

Under the provisions of the Rural Telephone Act His Honor the Lieutenant Governor by and with the advice of the Executive Council has ordered that approval be granted to the Raymore Telephone Company to incorporate as a joint stock company under the Companies Act.

The following rural telephone companies have been incorporated in Saskatchewan: Glenford Rural Telephone Company, Limited, Glenside; Schneider Rural Telephone Company, Limited, Weyburn; Kingsley Rural Telephone Company, Limited, Windthorst; Luton Rural Telephone Company, Limited, Dubuc.

## Renfrew, Ont.

Telephone communication has been established between

Pembroke and Allumette Island, Chapeau and Chichester by cable across the Ottawa River.

## Sarnia, Ont.

The Sarnia Gas and Electric Company have placed an order with the Canadian Westinghouse Company for a 1,000 kw. turbo-generator.

## Saskatoon, Sask.

When the Saskatchewan Government took over the telephone system in 1908, there were only 497.2 miles of long distance pole line in the province. At the end of April, 1914, this mileage had been increased to 3,393.17, connecting up three hundred towns and villages in the province and enabling communication with over 17,000 local subscribers and 7,989 rural subscribers. By the end of the present season a further remarkable extension of lines will evidence the activity of the provincial department.

## St. Catharines, Ont.

It is reported that the Marathon Tire Company have undertaken to equip their factory with electric machinery and have promised to purchase power from the city council.

## St. Marys, Ont.

At a recent meeting of the Water, Light and Heat Commission, it was decided that the present time is not opportune for undertaking a complete new street lighting installation. In the meantime the small lamps on the main streets will be replaced by much larger ones, and it is believed the town will be sufficiently well lighted for the coming winter.

## St. Thomas, Ont.

The Hydro-electric Commission of St. Thomas announce that they have added 231 consumers during the last seven months.

It is understood that the installation of a new street lighting system on Talbot street will be proceeded with without delay.

Owing, it is said, to the financial stringency, work will be temporarily delayed on the electrification of the London and Port Stanley railway system.

## Toronto, Ont.

The Electrical Workers' Society have appointed a committee to deal with the matter of making provision for the dependents of such of their members as have already gone, or may go, to the war. It has been agreed to keep the fees of these members paid up and to maintain their standard for sick and funeral benefits.

## Walkerville, Ont.

It is claimed that local applications for hydro service have been coming in at the rate of about ten a day since it was announced that the contract has been closed for the purchase of the local system by the municipality.

## Wingham, Ont.

It is said that the farm of Reeve Bissett, of Colborne Township, is now considered the most modern dairy farm in the district, on account of the installation of electrical equipment operated by Niagara power. Mr. Bissett has installed milking machinery, motors for cutting and storing ensilage, pumping water and operating other machinery about the house and buildings. The farm comprises 600 acres of land and 60 cows are at present milking night and morning.



# TRUMBULL

"Circle T"

## SWITCHES

TYPE "C"

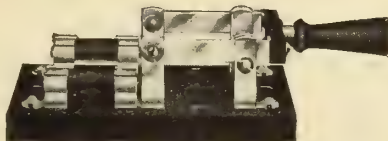


Struck up type. 30-200 Amp.

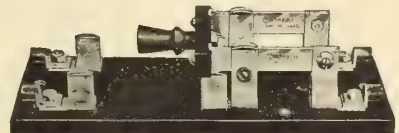
Front Connections plain finish only.



Double Pole No Fuses.



N. E. C. Fusible, High Jaws, Fused Bottom.



N. E. C. Fusible, High Jaws, Fused Top.



600 Volts.

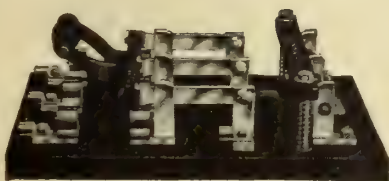


500 V. A. C.

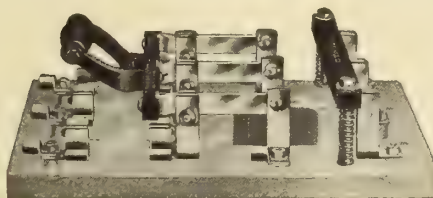
Our type "C" line is the standard for this style of switch.

The best selling punch clip switch on the market.

### A. C. Motor Starting Switches



Type "A" Fusible One End Only.



Type "C" Showing Straps on Back.

See catalogue No. 10 for the most complete line of knife switches on the market.

If you don't know these motor starting switching get acquainted NOW.

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PHILADELPHIA  
138 N. 10th St.

SAN FRANCISCO  
84-88 Second St.



# Condensed Department

## Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

## EMPLOYMENT WANTED

Electrical Switchboard Operator, married, desires change. Experienced in A.C. and D.C. work. Present position hydro plant, two years. References. Box 67, Electrical News, Toronto.

18-19

Electrical Engineer desires position. Experienced in Construction and Maintenance, Electric Light, Power and Railway Plants.

Box 73, Electrical News,  
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Salesman and Designer for large Electric Fixture Manufacturer, competent to sell special work. Must be able to estimate costs and have knowledge of illumination. Excellent opportunity. Applications confidential. Apply Box 58, Electrical News, Toronto.

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NEW BOOKLET OF COMPLETE INFORMATION FREE  
(MENTION THIS PAPER) M. 3713

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We have the largest stock in America.  
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MacLean Reports will put you in touch with the right job at the right time, the right man to see and the right place to find him. It will pay you to use them in your business. Rates and samples on application.

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FINE BANK OFFICE, COURT HOUSE & DRUG STORE FITTINGS. OFFICE, SCHOOL, CHURCH & LODGE FURNITURE.

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## Lighting Schedule for October, 1914

Courtesy of the National Carbon Company, Cleveland

Date.	Light.	Date.	Extinguish.	No. of Hours
Oct. 1	1 50	Sep. 1	5 10	3 20
2	2 50	2	5 10	2 20
3	No Light	3	No Light	
4	No Light	4	No Light	
5	No Light	5	No Light	
6	No Light	6	No Light	
7	6 00	7	8 20	2 20
8	6 00	8	9 00	3 00
9	6 00	9	9 40	3 40
10	5 50	10	10 40	4 50
11	5 50	11	11 30	5 40
12	5 50	12	0 50	7 00
13	5 50	13	1 50	8 00
14	5 50	14	3 10	9 20
15	5 50	15	4 20	10 30
16	5 50	16	5 30	11 40
17	5 40	17	5 30	11 50
18	5 40	18	5 30	11 50
19	5 30	19	5 30	12 00
20	5 30	20	5 30	12 00
21	5 30	21	5 30	12 00
22	5 30	22	5 40	12 10
23	5 30	23	5 40	12 10
24	5 30	24	5 40	12 10
25	5 30	25	5 40	12 10
26	10 40	26	5 40	7 00
27	11 40	27	5 40	6 00
28	0 50	28	5 40	4 50
29	1 50	29	5 40	3 50
30	2 50	30	5 40	2 50
31		31	5 40	

Total Hours..... 204.30

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Canadian Amber

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BRANCHES—34 West 33rd St., New York Kodarma, Bengal, India

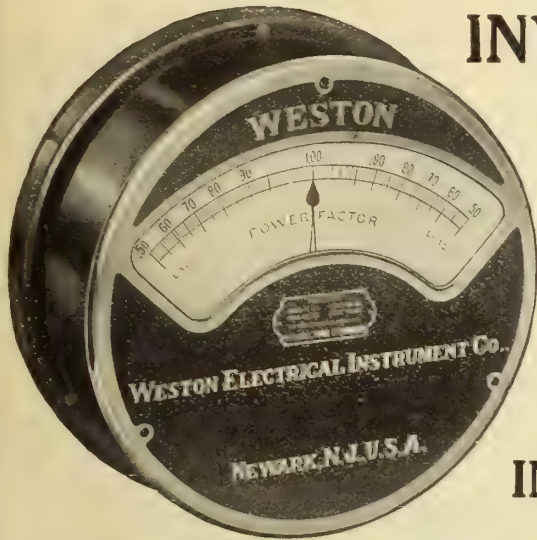
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Dust and Oil Rings, Buffers, Lubricating Pads, Wicks for Fan Motors, and felts of every kind for electrical and mechanical uses.

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Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

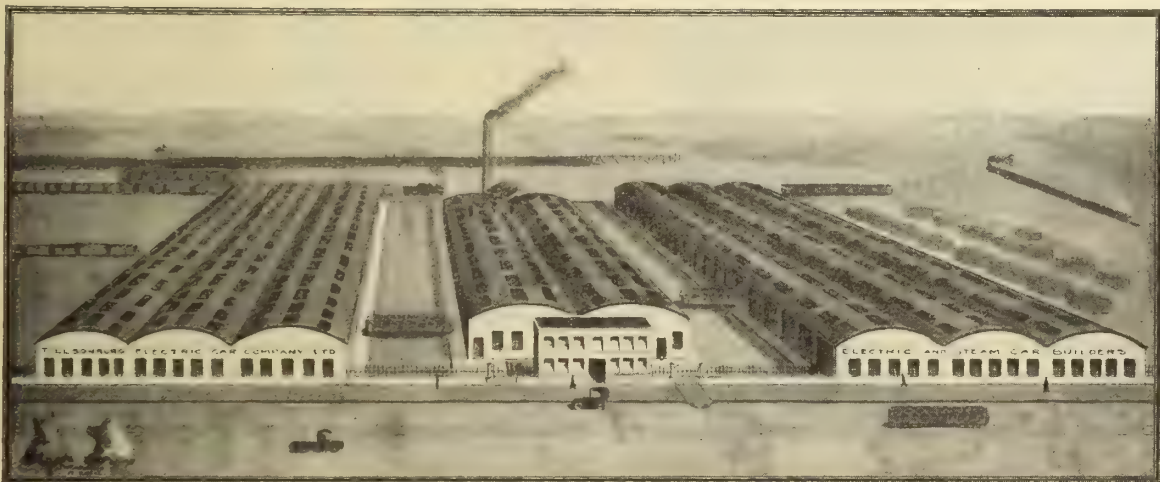
## WESTON ELECTRICAL INSTRUMENT COMPANY, Main Office and Works, NEWARK, N. J.

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Badt-Westburg Elec. Co., 832 Monadnock Block, Chicago, Ill.  
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Mr. Geo. H. Moseman, 176 Federal St., Boston, Mass.

Mr. Milton Mill, 915 Olive St., St. Louis, Mo.  
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FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

*Prompt Shipments from Canadian Factory.*

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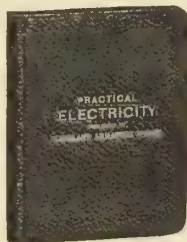
Canadian Office and Factory, HAMILTON, ONT.

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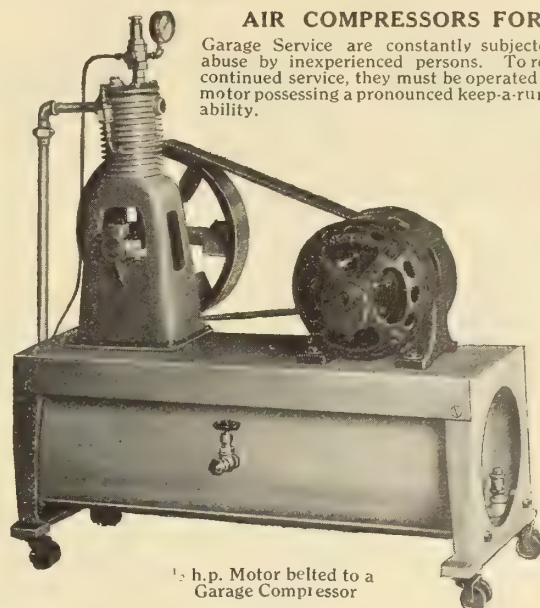
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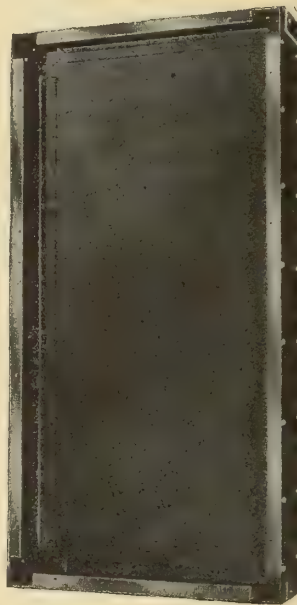


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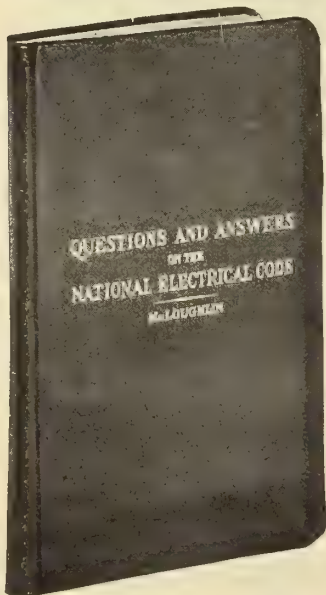
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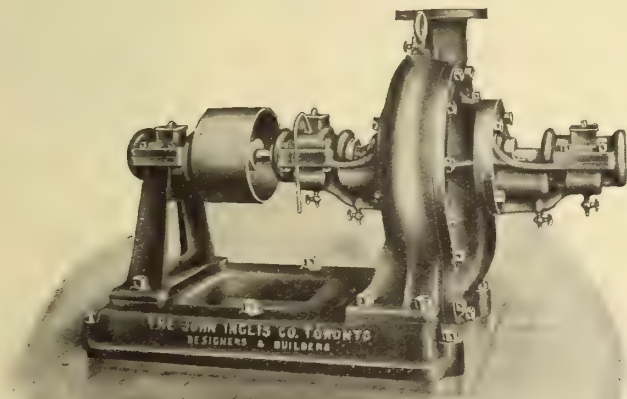
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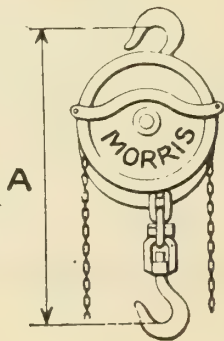
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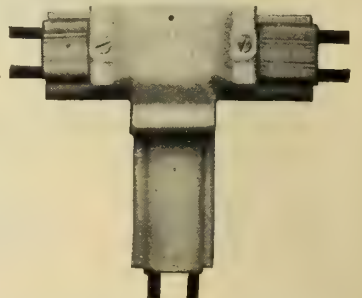
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**Electro-Dynamos**, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company, 298 pages. Price 50c.

**Electrical Engineering**, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price \$3.00.

**Radiation, Light & Illumination**, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price \$2.50.

**Electric Motors**, by Crocker & Arndt. Published in 1910 by D. Van Nostrand & Company. Price \$2.00.

**Short Course in Testing Machinery**, by Morecroft and Hehrs. Published in 1911 by D. Van Nostrand & Company. Price \$1.

**Dynamo Electrical Machinery**, by Sheldon & Hausman. Published in 1910 by D. Van Nostrand & Company. Price \$1.50.

**Electricity—Experimentally and Practically Applied**, by Ashe. Published in 1910 by D. Van Nostrand & Co. Price \$1.00.

**The Dynamo (2 volumes)**, by Hawkins & Wallis. Published in 1909 by Whittaker & Company. Price \$4.00.

**Steam Turbines**, by Kennedy. Published in 1910 by Whittaker & Company. Price \$1.00.

**Dynamo-Electric Machinery**, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price \$1.00.

**Telephone Law**, by A. H. McMillan. Published in 1908 by McGraw Hill Publishing Company. 332 pages. Price \$1.50.

**Practical Methods of Electro-Chemistry**, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price \$1.00.

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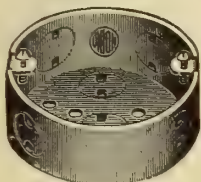
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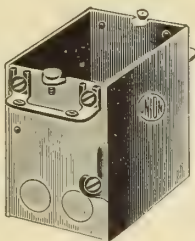


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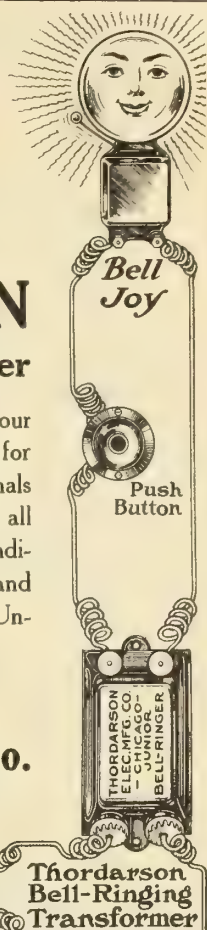
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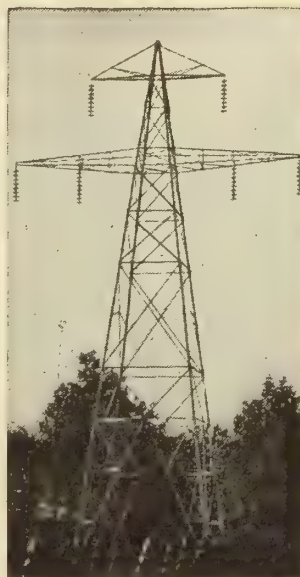
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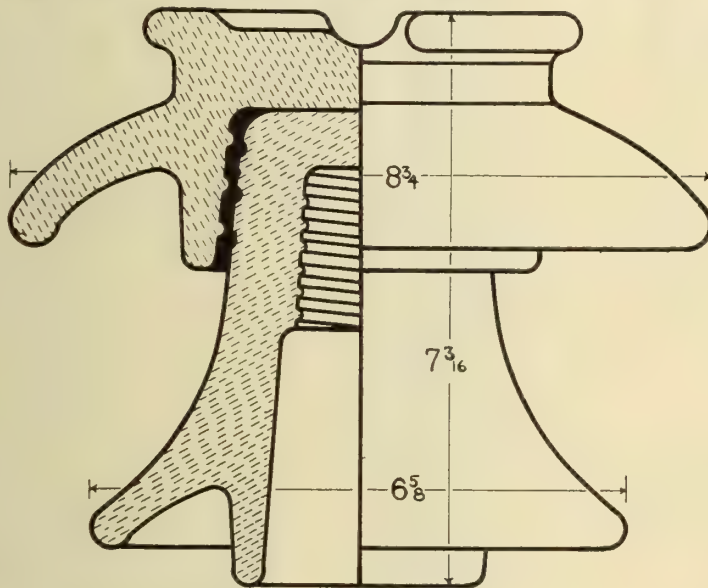
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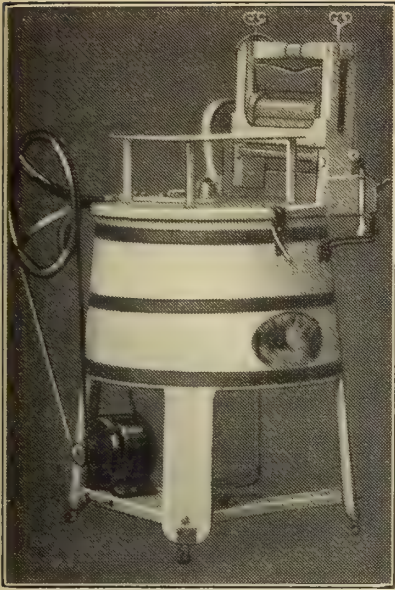
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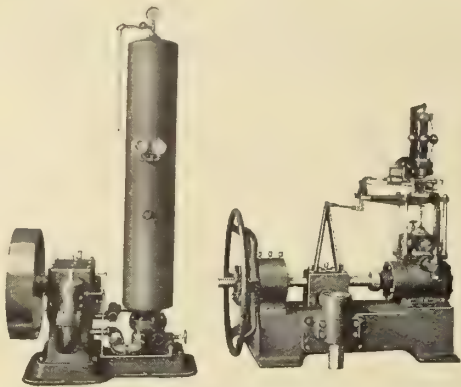
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**William Hamilton Company, Limited**  
Peterborough, Ontario





## THE GOVERNOR FOR YOUR CONDITIONS

We are specialists in the manufacture and application of hydraulic governing apparatus.

The knowledge and the shop equipment which enable us to build the 250,000 ft. lb. governors for the Mississippi River Power Co. at Keokuk, are at the command of the purchaser of any of our governors.

**WHAT IS YOUR PROBLEM?**

**THE LOMBARD GOVERNOR CO.** ASHLAND MASS.

564 Candler Bldg., Atlanta, Ga.  
Pacific Coast Agents:—Pierson, Roeding & Co., 118 New Montgomery St., San Francisco, Cal.

**QUALITY**

**EFFICIENCY**

## MICABOND

*The Standard Mica Insulation*

**Sheets—Washers—Rings—Tubes  
Segments—Special Shapes**

The  
**CHAMPION**  
OILED FABRICS

—Manufactured by—

**The Chicago Mica Co.**  
Valparaiso, Ind., U. S. A.

**Frank G. Scofield**

Canadian Sales Representative  
Lumsden Bldg., Toronto, Ont.

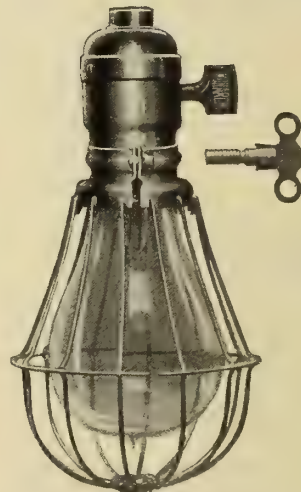
## The Lock On Guard

Supersedes all other Guards  
and is

**Made in Canada**

By

**THE MONARCH ELECTRIC CO.**  
LIMITED  
ST. LAMBERT, P.Q.



No. 1—Lock On Guard

ORDER  
LOCK ON GUARD

No. 1—For 16 c.p.  
Lamps.

No. 2—For 16 c.p.  
Lamps.

No. 3—For 32 c.p. and  
60 Watt Lamps.

No. 4—For 32 c.p. and  
60 Watt Lamps.

Nos. 1 and 3 fit Standard  
Sockets.

Nos. 2 and 4 fit Porcelain  
Sockets also

Nos. 9366-43310 and  
60666 Sockets.



## KNIFE SWITCHES

30 to 5000 AMPERE



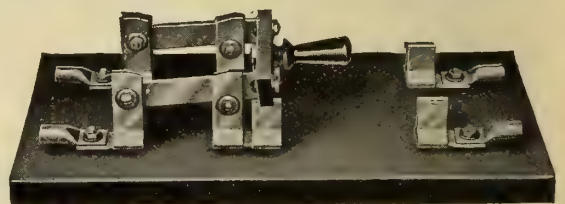
Type "A" See catalog, pages 6 to 11.

**FRANK ADAM ELECTRIC COMPANY**

Front Connected  
Back Connected

Motor  
Starting  
Switches

Write for  
catalog No. 21



Type "F" See catalog, pages 16 to 21

**ST. LOUIS, Missouri, U. S. A.**





## You Don't Need To Worry About Your Electrical Repairs

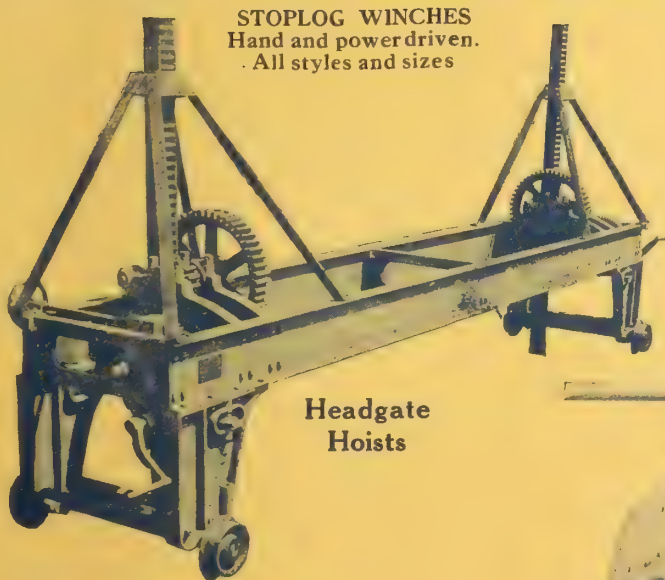
We have adequate facilities for handling all kinds of electrical repairs, large or small. Our expert repairmen are always ready at a moment's notice to go out, day or night.

Always keep in mind that our service is **guaranteed**—your repairs will be executed by competent men in the shortest possible time.

*One trial will convince you.*

ADELAIDE 902 or 903 during the day. BEACH 1723 or 1930, nights, Sundays or holidays.

The **Electrical Maintenance & Repairs Co., Limited**  
Toronto 162 Adelaide St. West Ontario



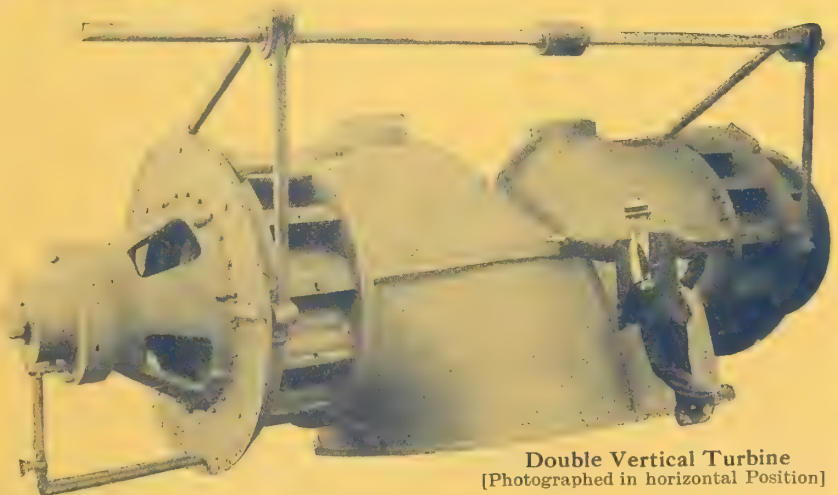
STOPLOG WINCHES  
Hand and power driven.  
All styles and sizes

Headgate  
Hoists

Machine Cut Gears  
Extra large stock patterns for  
Heavy Bevel Gears  
having wood and iron teeth.  
Heavy Pulleys and  
Bearings, etc.

## Water Power Plant Machinery

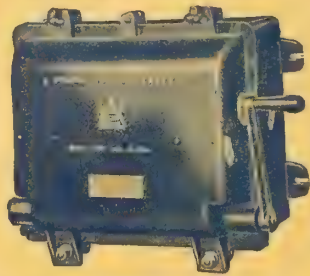
Steel Castings  
Propeller Wheels



Double Vertical Turbine  
[Photographed in horizontal Position]

**THE WM. KENNEDY & SONS, LTD., Owen Sound, Ont.**





600-Volt 3 Phase Starter for  
Motor up to 7½ H.P.

## “Detroit” Ironclad Induction Motor Starters Meet the Most Rigid Requirements of the Hydro-Electric Power Commission

Installations of “DETROIT” Ironclad Motor Starters combine, in the highest possible degree, the elements of safety and efficiency for both the employees and the machines.

### 5 Big Reasons Why

Here are five factors of safety and efficiency—five big reasons why the above statement is absolutely true:

- 1—Motor is fused for its running load—A factor of safety for motor.
- 2—Starter is operated from outside of box—A factor of safety for employee.
- 3—No live parts of starter exposed—A factor of safety for employee.
- 4—Cover of box can be sealed shut—A factor of safety against tampering.
- 5—Starter can be locked “off”—A factor of safety against carelessness.

Send for Bulletin No. 29

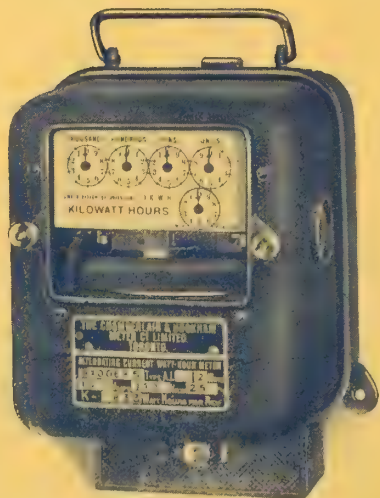
**DETROIT FUSE & MFG. COMPANY, Detroit, Mich.**

Western Canadian Agents—  
Bentz-Richardson Co., Limited,  
114 Phoenix Block, Winnipeg, Man.

1404 Rivard St.

Eastern Canadian Agents—  
McNaughton McKay Electric Co., Limited  
216 Wyandotte St. East, Windsor, Ont.

# SPECIALISATION



Most of the epoch making developments of modern industrial progress are without doubt the result of specialisation.

One product of this era of persistent concentrated effort is the C & H Meter, in its present form—the result of 32 years experience of meter practice.

Our existence depending on the quality of our meter, it is only reasonable to expect a little better meter and a little better service than if our attention were divided among many different lines.

## Chamberlain & Hookham Meter Co., Limited

TORONTO, 120 Richmond St. W., ONTARIO

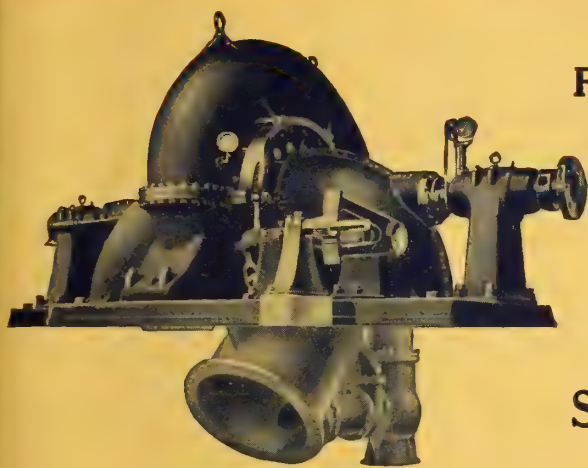
WINNIPEG, 61 Albert St., MANITOBA

Spencer & Aspinall, Ltd., 617 New Birks Bldg., Montreal, P.Q.



# Electrical News

Generation, Transmission and Application of Electricity



5250 Horse Power 275 Feet Head

## 90% EFFICIENCY From SMITH HYDRAULIC TURBINES

Recent tests at Holyoke, Mass. of Smith Turbines have again proven their superiority over any turbine now manufactured.

These tests showing efficiencies from 89% to over 90%.

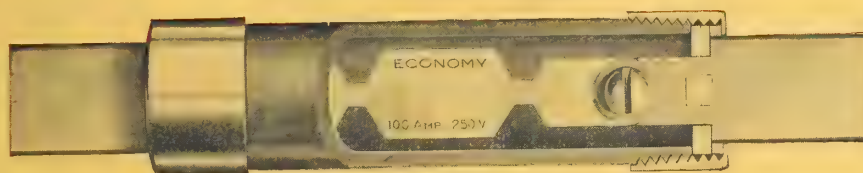
We design and build turbines for heads from 5 feet to 650 feet.

*Send for Bulletin N*

**S. Morgan Smith Co., York, Pa.**

Branch Offices: 176 Federal St., BOSTON, MASS.  
614 American Trust Bldg., CHICAGO

**"Look for the Gray Shell"**



Sectional view, Economy Knife Blade renewable cartridge Fuse.

## ECONOMY Renewable Cartridge FUSES

made in Canada and sanctioned by the Canadian Fire Underwriters' Association.

New, improved types of ferrule and knife blade fuses are now offered in all capacities and commercial voltages. The Economy "Drop Out" Renewal Link is the greatest improvement in enclosed fuse manufacture since fuses were first put on the market. It is now used in all sizes of Economy fuses, both knife blade and ferrule types, except in the ferrule type under 15 amperes. Its uses makes filling material of any description unnecessary. Renewals are made easily and quickly. The protection afforded by Economy renewable cartridge Fuses is absolute—and a saving of at least 80 per cent. per year in fuse maintenance is being effected wherever they are in use. Two renewal links are furnished free with every Economy Fuse.

In order to make the new types known to the trade and to fuse users, we will be glad to send samples of any desired capacities without charge. Please state your requirements.

WRITE TO-DAY

**Economy Fuse & Mfg. Co. of Canada, Ltd.**  
Unity Building - Montreal

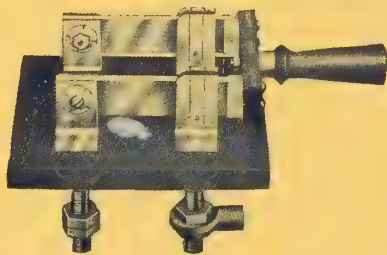
Manufacturers in Canada of "S & C" Extra High Potential Fuses—to 150,000 volts.



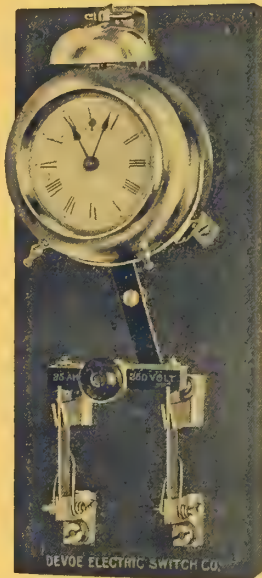
# DEVOE

## Switches and Steel Boxes

An examination of DEVOE switches and steel boxes will convince you they are the best made.

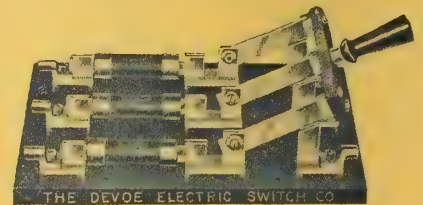


Cut No. 268



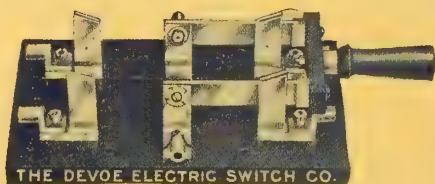
Type "A"

Every DEVOE product is built for efficient service under actual operating conditions.

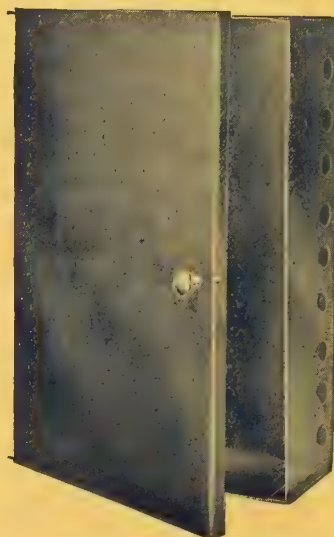


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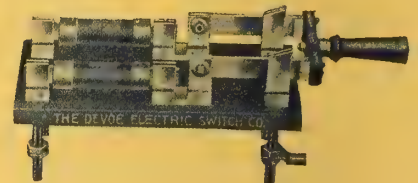
These boxes are formed from one piece of steel, the corners of the bodies are folded in and securely riveted.



THE DEVOE ELECTRIC SWITCH CO.



The corners lap over the edges of bodies on all four sides making these boxes absolutely DUST PROOF.



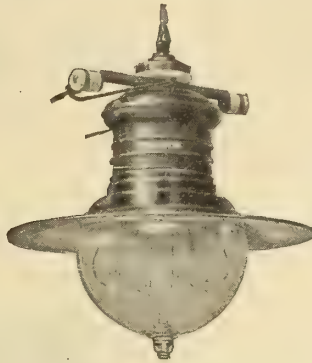
Cut No. 2005

*When specifying insist on Devoe Switches and Steel Boxes*

**The Devoe Electric Switch Co.,** 157 Craig St. West  
Montreal, Que.

Frank G. Scofield, Ontario Sales Representative, Lumsden Building, Toronto, Ontario





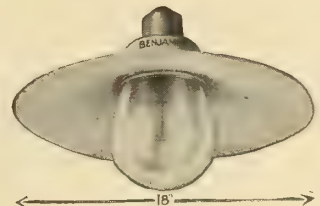
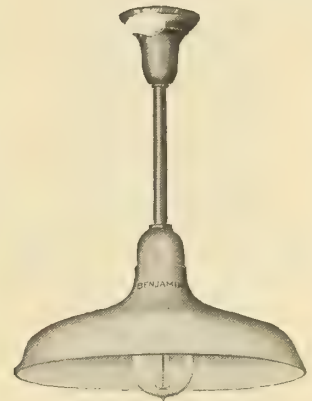
There is a  
**BENJAMIN**  
 —REFLECTOR—  
 —FIXTURE—  
 —UNIT—

for every lighting condition and requirement. The service of our engineering department is yours for the asking. This combination of high class material and expert engineering service

**IS THE BENJAMIN WAY**  
 to secure perfect illumination.

*Write for catalog C-21 and  
 Bulletin 222*

**Benjamin Electric Mfg.  
 Co. of Canada, Limited**  
 TORONTO - CANADA





## The Lock On Guard

Supersedes all other Guards  
and is

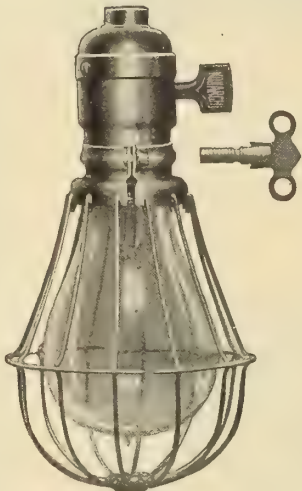
Made in Canada

By

THE MONARCH ELECTRIC CO.

LIMITED

ST. LAMBERT, P.Q.



No. 1—Lock On Guard

ORDER  
LOCK ON GUARD

No. 1—For 16 c.p.  
Lamps.

No. 2—For 16 c.p.  
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No. 3—For 32 c.p. and  
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No. 4—For 32 c.p. and  
60 Watt Lamps.

Nos. 1 and 3 fit Standard  
Sockets.

Nos. 2 and 4 fit Porce-  
lain Sockets also

Nos. 9366-43310 and  
60666 Sockets.

*"Do it Electrically"*

## ELECTRIC SIGNS

OF EVERY TYPE AND DESIGN



By

*The Macey*  
SIGN CO.

LIMITED

257 King Street West,

TORONTO

Lighting Companies write us about our  
ELECTRIC SIGN CAMPAIGN

## ARTISTIC STREET ILLUMINATION

*With Nitro Lamps*

Fixtures Specially  
Constructed

Proper Ventilation

Special Glassware

Pleasing Design

Brackets Supplied to  
Suit Conditions

Fixtures Interchangeable  
for Multiple or Series  
and

Designed to Take Any Size  
or Make of Lamp



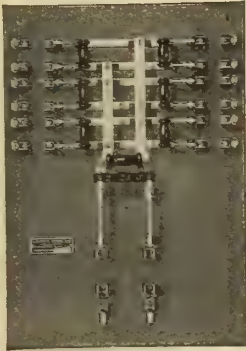
A. H. Winter Joyner, Limited, 76 Bay St., Toronto

"CONSULT A SPECIALIST"



# Panel Boards and Cabinets

That Embody Advanced Structural Principles.  
Material and Workmanship the Best



Type A Panel

**O**UR line of Panel Boards includes four distinct types, each made in single and double branch forms, with mains carrying lugs only, fuses, fuseless knife switch, and fused knife switch for 2 to 2 and 3 to 2 wire systems. Three to 2 wire Panel Boards are made in convertible form as well as the standard construction.

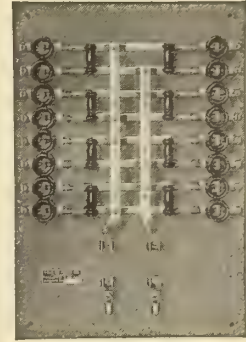
Type "A" Panels [125 and 250 volts] — Branches arranged for enclosed fuses and with or without knife switches.

Type "D" Panels [125 volts] — Branches arranged for plug fuses and with or without knife switches.

Type "F" Panels [125 and 250 volts] — Branches arranged for enclosed fuses and snap switches.

Type "H" Panels [125 volts] — Branches arranged for plug fuses and with snap switches.

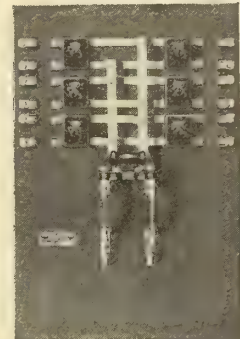
Our designs in Cabinets embrace fifteen types—all steel, steel and wood combined and wood with slate lining, either for flush or surface mounting and with side or back gutters, also without gutter.



Type D Panel



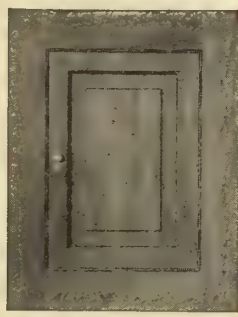
Type H Panel



Type F Panel



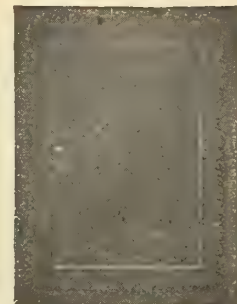
Type M Cabinet



Type DFP Cabinet



Type ESQ Cabinet



Type CL Cabinet

If your dealer does not stock them, write us.  
Panels and Cabinets, Bulletin No 1 sent free upon request.

## Crouse-Hinds Co. of Canada, Ltd.



Main Office and Works:  
**Toronto, Ontario, Canada**

Kindly send me free copy of Bulletin No. 101  
Name.....  
City.....  
Prov.....  
21013





# EUREKA

## Increased Sales Reduce Price \$5.50

Because it is the best portable cleaner, as proved by five years steady use, the Eureka has prospered. Its sales have grown to colossal proportions and its popularity is nation wide.

Because of the large quantities of Eureka's that we are selling, a reduction in price has been possible.

The Eureka is now selling retail for \$39.50 east of Winnipeg and for \$44.50 in Winnipeg and the West. This means a reduction of \$5.50.

Complete set of attachments \$10.00 extra.

Write us for dealers' proposition.

## Onward Mfg. Co.

Berlin, Ont.



## For Satisfactory Transformer Service specify

# “MOLONEY”

Satisfaction

## Transformers

QUICK SHIPMENTS.

## Moloney Electric Company of Canada, Limited

WINDSOR, ONTARIO

General Sales Office—Traders Bank Building, TORONTO

Branch Offices

MONTREAL

WINNIPEG

CALGARY

VANCOUVER



# Ornamental Lighting Standards

In this electrical age most cities are installing ornamental street lighting standards. A well lighted town is always a busy town and is destined to grow and prosper.

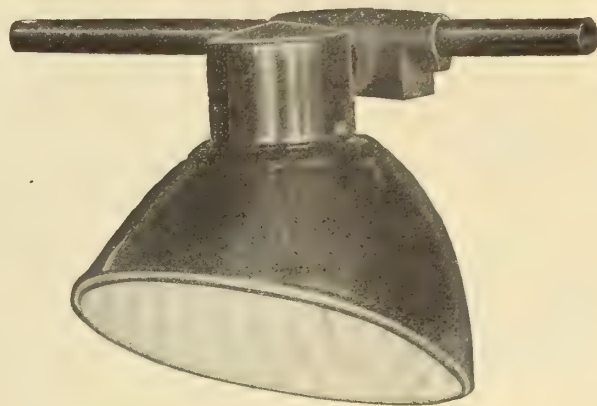
We have a very attractive line of standards and can supply stock or special designs at interesting prices.

During the past few months we have supplied ornamental lighting standards for the following places:—

Brantford, Ontario  
Edmonton, Alta.  
Windsor, Ontario  
Outremont, Quebec  
London, Ontario  
Orillia, Ontario  
Listowel, Ontario  
Peterborough, Ontario  
Belleville, Ontario

*Write our lighting pole department  
for full information.*

**William Hamilton**  
Company, Limited  
Peterborough, Ont.



## "SCOOPETTE"

**This new X-RAY Reflector standardizes  
show case lighting**

In repeated conference with some of the most successful store managers and show case manufacturers our engineering and manufacturing departments have produced a show case lighting device that is as far in advance of any other appliance on the market as the X-RAY Window lighting reflectors are in their field.

The following are the important considerations which the "Scoopette" alone has fulfilled:

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. The unit must be as unobtrusive as possible. The merchandise display must be clearly visible from every angle.</li> <li>2. The case must be lighted evenly and brightly which necessitates a scientifically designed reflector.</li> <li>3. The lighting equipment must be neat to maintain the dignified appearance of the modern all-glass show case.</li> <li>4. The current consumption must be the lowest possible, which</li> </ol> | <ol style="list-style-type: none"> <li>5. Lamps used must be easy to obtain, low in cost and the fewest number used to reduce maintenance cost to the minimum.</li> <li>6. It must be easily installed and equally efficient in any kind of show case, whether wood, metal frame or all glass.</li> <li>7. Its selling price must be reasonable.</li> </ol> |
|---|---|

### Prices on application

**Have you entered our \$500 cash prize sales  
contest?**



Night-photograph showing "Scoopette" lighting.

**National X-Ray Reflector Co.**  
CHICAGO  
225 W. Jackson Blvd.  
NEW YORK  
6 East 39th Street



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**The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers**



**G  
A  
L  
V  
A  
D  
U  
C  
T**



New C. P. R. Hotel Palliser, Calgary.

### A "Galvaduct" Building

This hotel owned by Canada's Largest Railroad is equipped with the world's best conduit.

#### "GALVADUCT"

The most perfect interior construction conduit on the market. Recognized as the standard of high quality.

Always specify "Galvaduct" or  
"Loricated" Conduits

#### "LORICATED"

A high-class interior construction conduit of the enamelled type proof against acid or other corrosive agents.

If your jobber cannot supply  
you—write us

**Conduits Company  
Limited**

**Toronto - Montreal**

**L  
O  
R  
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C  
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T  
E  
D**



# Northern Light

## SERIES and MULTIPLE LAMPS

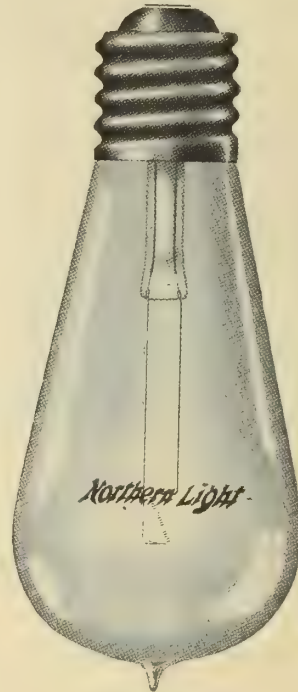
→ THIS COMPARE WITH THIS ←

### Nitrogen Filled Tungsten

Constant Current Transformer—  
50 KW 100 c.p. H.E. lamp  
consumes 80  
watts

$\frac{50000}{80}$  625 lamps

If you use H.E. Lamps, you can operate 125 more of the 100 c.p. size 5.5 amp., on a 50 KW Constant Current Transformer than you can Carbon filament Vacuum 100 c.p. 5.5 amp. lamps.



### Vacuum Carbon

Constant Current Transformer—  
50 KW 100 c.p. carbon  
lamp consumes  
100 watts

$\frac{50000}{100}$  500 lamps

For the same candlepower and amperage—both lamps cost you exactly the same price.

*Ask Our Nearest House*

We sell nitrogen filled High Efficiency Multiple lamps in sizes ranging from 200 watts to 1000 watts per lamp.

They make blue look bluer  
They make green look greener  
They make white look whiter  
They make black look blacker  
And everything look brighter



The life of Northern Light High Efficiency lamps is 1000 hours. They have a "getter" in them which prevents rapid blacking.

*Northern Light*

**Lamps**

are made in Canada

by Canadians

for Canadians

Look for the name on every bulb



## Northern Electric Company

LIMITED

MONTREAL  
HALIFAX  
TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA







Here is a  
**money-making opportunity**  
**for Electrical dealers and Contractors:**

## A NORTHERN ELECTRIC **Advertogram**

A Northern Electric ADVERTOGRAM will revolutionize the selling effectiveness of any show window. It is fifty inches long, holds twenty six letters or slides at one time, is well made and handsomely finished.

Clothing Stores and Haberdashers, Hardware Stores and Druggists, Grocers, Hat Stores, Boot Stores and Music Stores, are only some of the many retailers who can make the best use of the Northern Electric ADVERTOGRAM for the increasing of sales.

From this partial listing of prospective customers, you will readily see the splendid sales making opportunities that await you in your home town and vicinity.

With each outfit is furnished 125 assorted slides, scientifically arranged, containing characters, numerals, blanks, etc., from which many different advertisements may be written.

To the man who is willing to push the sale of this specialty, we are prepared to make an attractive proposition.

*Write today  
 for Further  
 Particulars.*

***Northern Electric Company***

LIMITED

MONTREAL  
 HALIFAX  
 TORONTO

WINNIPEG  
 REGINA  
 CALGARY

EDMONTON  
 VANCOUVER  
 VICTORIA



From generator to consumer you  
should install

# Northern Electric Wire and Cable

In the largest wire plant in Canada—under the Northern Electric trade mark and guarantee is manufactured **every type** of wire and cable, including

## High Tension, Lead covered Paper Insulated, Power Cables

Northern Electric Wires and Cables are the most carefully made—the most rigidly tested—the most universally satisfactory transmission in use today. From raw material to finished product the skilled workmanship of our operatives is **continuously** supervised and inspected. Electrical engineers whose reputations have been made on exacting work of great magnitude, use Northern Electric Wire and Cables.

One order recently received from the Montreal Light, Heat and Power Company and another from the Cedars Rapids Manufacturing and Power Company together constitutes the largest single order ever placed for lead covered high tension power cable. The first mentioned concern has more underground cable installed than any other public service corporation—and its engineers **know** Northern Electric dependability from comparative tests **in service**.

The Northern Electric line includes :

**Cable Terminals, Compounds, Junction  
Boxes and other accessories.**

*Write for data on any wire or cable problems that confront you*

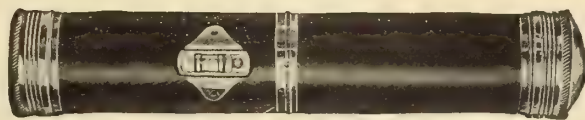
***Northern Electric Company***  
LIMITED

Montreal  
Halifax  
Toronto

Winnipeg  
Halifax  
Calgary

Edmonton  
Vancouver  
Victoria

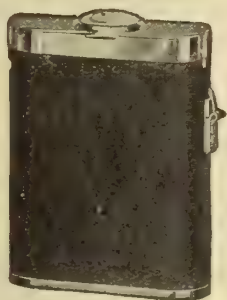




# Famous Eveready Flashlights

## —Made in Canada

**YOU** are letting a lot of profitable business get past you if you are not handling Eveready Flashlights.



This is one line you can sell to all ages and conditions of your trade. Men want them; hunters, motorists, canoeists and campers. For business purposes, too; meter readers, watchmen, etc.



Women who are timid about going about a dark house alone want them. Old ladies who have to go out alone at night want them.

Children delight to play with them—(safe from any danger of fire)!

Everybody wants them. Can you supply them?

**Get your share of this Profitable Business.**

DISTRIBUTORS :

***Northern Electric Company***  
LIMITED

MONTREAL  
HALIFAX  
TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA



# *For Your Railway Motors* **Speer "Type G" Brushes**

for long life, efficient commutation, absence of sparking and good lubrication. Unexcelled by any brush foreign or domestic. Get the facts.

## **Speer Carbon Company** ST. MARYS, PA.



CITY HALL, WINNIPEG—Photo taken at night, Feb. 20th, 1914, illustrating the remarkable Candle Power of Laco "Nitro" Lamps.

## **"Nitro" High Efficiency Lamps**

Are suitable for all lighting purposes. They give three times the light with the same amount of current required by the ordinary tungsten lamp.

They are particularly adapted for lighting large areas, and for out door use.

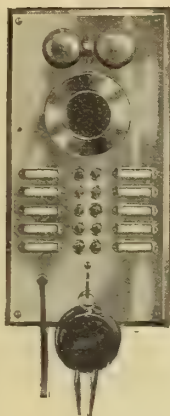
***Durable—Economical  
Efficient***

**The Mainer Electric Co.**  
WINNIPEG, MAN. Limited

The Largest Electrical Supply House in the West.







## Profitable Instruments

### For the Dealer

Here's a line of Interior Telephones and Electric Reset Annunciators that give great satisfaction to users. We have specialized in this class of work for twenty years and can offer dealers an exceptionally good proposition.



## Electric Reset Annunciators

stand for superior quality and reasonable price. They are made to give lasting service and do not get out of order. They have many advantages not possessed by other makes.

*Write for catalog 22C and special agency proposition.*

*Handle this line in your city*

**Connecticut Telephone & Electric Company, Inc.**  
Meriden, Conn., U. S. A.



## UNIFORMITY!

in mechanical strength, wearing quality, firmness of texture and lubricating quality, **every**

## "LE CARBONE"

(Made in France)

## Carbon Brush

in a million is absolutely identical.

This means that a type of **Le Carbone Brush** once installed to meet your conditions will always meet them on subsequent shipments.

*Le Carbone quality never varies!*

## Rougier Freres Inc.

63 Notre Dame, East  
MONTREAL, P.Q.

## THE NEW ALKLUM ACCUMULATOR

### Special Advantages:

NO LEAD. NO ACID. NO CELLULOID CASE

#### Strength:

Cannot be hurt with overcharging or running down to Zero.

#### Size:

Smaller than any other Accumulator.

#### Life:

Ten times the life of Lead Accumulators.

#### Reliability:

The Voltage keeps practically the same all the time used.

#### Weight:

The Lightest in the World.

#### Convenience:

Having very wide charging rates.

Far in advance of any other Accumulator for Hand-lamps, because it can be left for any length of time without deteriorating. Absolutely the Best for Miners' Lamps, because it gives off the same amount of current the whole of the time it is in use, maintaining the light evenly throughout the day. Most satisfactory for Electric Self-starters. A great advantage over any other Accumulator for lighting cars.

Fully Descriptive Catalogue sent on application to the Makers

**WORSNOP AND CO., LTD.**  
LAMP WORKS, HALIFAX, ENGLAND.

Who are also the largest makers of Electric Motor Lamps in the World.

**GUARANTEED TO BE SUPERIOR TO ANY  
OTHER ACCUMULATOR IN THE WORLD.**

## Electrical Decorations For Rent

**W**E make a specialty of High-Class Decorations for Street Fairs, Carnivals, Celebrations, Centennials, Old Home Weeks, Street Conventions, Conclaves, Parks, Buildings, Auto Shows, Balls, Fairs, Dances, Banquets, Industrial Expositions, Food Shows, Christmas and New Years, etc.

Our decorations are elaborate, appropriate and refined. We carry a complete line of Electrical Set Pieces, Signs, Streamers of Lights and Bunting for all Lodges, Orders and all occasions. Get our prices and designs.

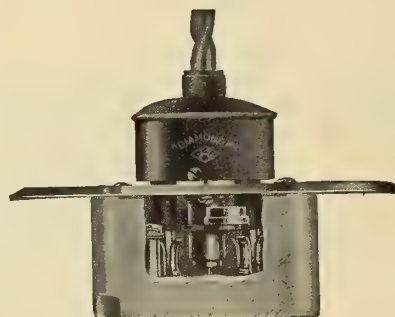
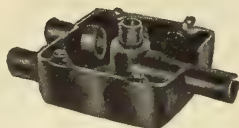
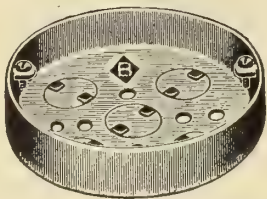
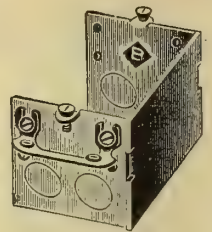
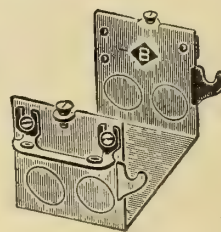
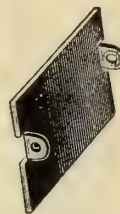
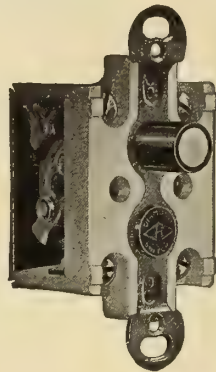
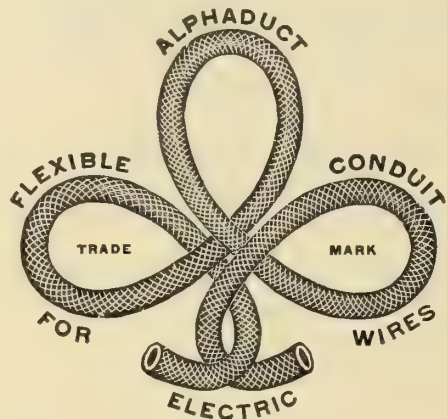
Contractors and Dealers are requested to get in touch with us.

**Electrical Decorative and  
Equipment Company**

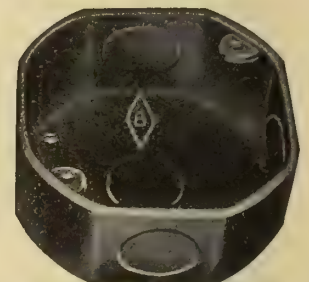
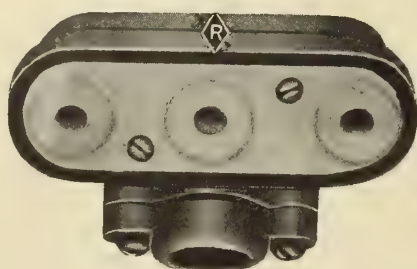
70 Lombard Street, Toronto, Ont.  
Long distance phone Main 3634



# Electrical Fittings



"Diamond H" Switch



## Electrical Fittings Co., Limited

331-3 King Street West, Toronto





# **ANNOUNCEMENT**



## **The D & W Fuse Company of Providence, R. I.**

*Manufacturers of the well known "D & W" Fuse*

Is pleased to advise its customers that it is now represented in Canada by the following concerns and that they are prepared for all requirements with a full line of "D & W" FUSES, CUT-OUTS and BOXES.

**Mechanics Supply Company, Limited, Quebec  
Electrical Equipment Co., Limited, Montreal  
Factory Products Limited, Toronto**



*Complete Stocks—Prompt Shipments*



## **SWEDEN**

**Has Remained Neutral**

## **OUR FACTORY**

**Is Filling Orders as Usual**

*Send us your inquiries.*

## **SWEDISH GENERAL ELECTRIC**

Head Office

**TORONTO**

**1011 Kent Building**



General Supplies

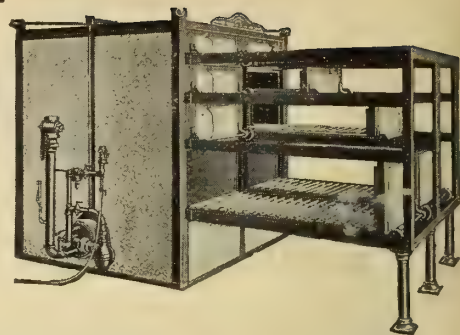
**CALGARY**

Limited



# Thorough Circulation

- + Highly Efficient Insulation
- + Enclosed Flame Gas Burners
- + Specialized Engineering Design



## == CRAWFORD Sectional Ovens

Therefore, Crawford Sectional Ovens are **best** for **japanning** and for **drying** armatures and coils. The perfect insulation on all six sides of the oven avoids heat leakage. The Enclosed Flame Gas Burners (no open flame) operate with city, natural, producer or gasoline gas, are absolutely safe and burn just the right amount of gas to give proper conditions. The design of our ovens insures a rapid, thorough **forced** circulation of preheated air.

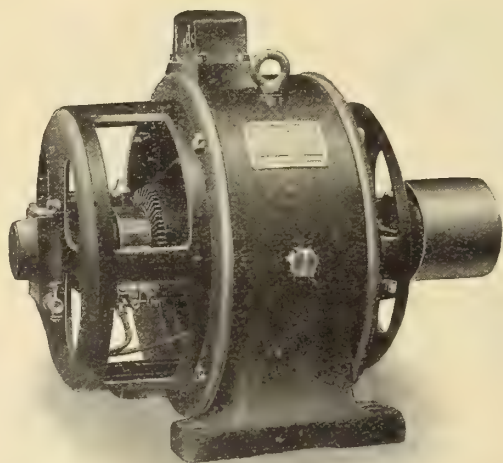
*Write today for catalog 9, describing and illustrating ovens of all types and sizes, or our folder, "Drying Out Armature Coils."*



**The Oven Equipment & Mfg. Co.**

New Haven, Conn.

54-31



# PEEBLES DIRECT CURRENT MOTORS

Our Toronto stock includes slow speed machines for direct coupling, as well as those of standard speed for belt drive.

**FERRANTI ELECTRICAL COMPANY OF CANADA  
LIMITED**

90 Sherbourne St.

**TORONTO**

Farmers Advocate Bldg.

**WINNIPEG**



# MADE IN CANADA

## *Packard* METERS

### *Accurate Recorders of Electric Currents*

The achievements of Packard Meters in the past fourteen years firmly establishes the truth of this statement and recent re-inspections of the Government furnishes the federal truth.

With every Packard Meter goes the reputation of a firm whose name in the past has become a by-word for meters—PACKARD.

Packard Meter service means a reliable meter service—what is it worth to you to know you can depend on your meters? Isn't it worth an investigation?

*Let us send you more detailed information.*

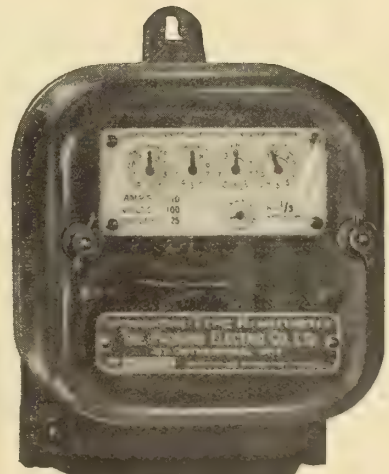
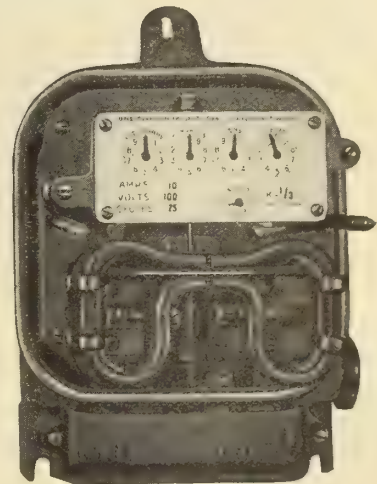
The **Packard Electric Co., Ltd.**

Factory at St. Catharines, Ont.

General Sales Office, N. W. Office and Warerooms  
Traders Bank Bldg., TORONTO WINNIPEG

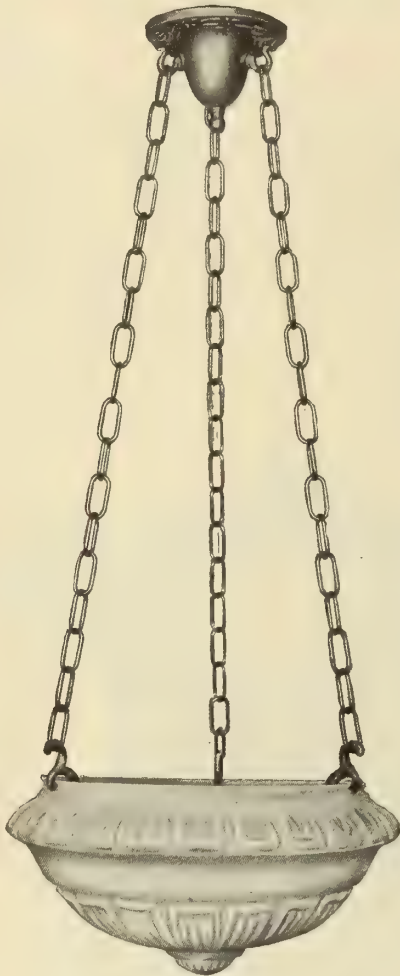
LARGE STOCKS CARRIED AT

St. Catharines and Winnipeg; St. John Railway Co., St. John, N. B.;  
General Supplies, Limited, Calgary, Alta.;  
Rudel-Belnap Machinery Co. Canadian Express Building, Montreal, Que.





# KNIGHT Electric Fixtures



No. 1025

Special  
October Offer  
**\$48.<sup>00</sup>**  
per doz. net

During October only we will supply our No. 1025 Semi-Indirect Fixture, exactly like cut, at the above remarkably low price—Packages charged at cost.

Length 30 inches over all—alabaster glass bowl 14 in. diameter.

No less than one half dozen sold at this price. If sample is desired, we will ship one at \$4.50 net.

Special  
October Offer  
**\$48.<sup>00</sup>**  
per doz. net

Our new electric fixture catalog will be ready for distribution about November 1st. Quantity is limited—send your name today to ensure receiving one.



Electric Fixtures  
Castings  
Pans  
Loops  
Chain, etc.

## H. W. Knight & Bro.

86 Richmond St. E., Toronto

## Alternating Current Direct Connected Units

60 CYCLE—3 PHASE

- 2 400 Kw. General Electric, form A, 550 Volt or 2300 Volt, 48 pole, 150 R.P.M., dir. conn. to 18-in. and 36-in. x 30-in. Buckeye, R.H., heavy duty CC. engines.
- 1 300 KW. Stanley 600 volt or 2300 volt, inductor type, 164 R.P.M., dir. conn. to 18-in. and 24-in. x 30-in. Russell tandem right hand, 4-valve engine.
- 1 300 KW. Crocker Wheeler, 600 volt, revolving field, 150 R.P.M., engine type—no engine.
- 1 240 KW. General Electric, 480 volt, ATB, form E, 200 R.P.M., dir. conn. to 17½-in. x 21-in. Buckeye heavy duty, piston valve engine.
- 1 200 KW. Westinghouse, 2200 volt, revolving field, 200 R.P.M., dir. conn. to 17½-in. x 20-in. Buckeye, right hand, horizontal, side crank engine.
- 1 160 KW. Crocker Wheeler, 240 volt, 257 R.P.M., dir. conn. to 15-in. x 17-in. Straight Line engine.  
Also smaller sizes.

## Alternating Current Dynamos— Belted

60 CYCLE—3 PHASE

- 1 300 KW. Westinghouse, 2200 volt or 550 volt, rev. fld., 3 bearing, 514 R.P.M.
- 1 250 KW. Bullock, 2200 volt or 550 volt, rev. fld., 12 pole, 600 R.P.M.
- 1 200 KW. General Electric, 2300 volt or 550 volt, ATB, form PB, 10 pole, 720 R.P.M.
- 1 200 KV.A. Westinghouse, 2400 volt or 600 volt, type G, 600 R.P.M.
- 2 200 KV.A. General Electric, form PB, rev. fld., 2300 volt or 550 volt, 10 pole, 720 R.P.M.
- 1 150 KW. General Electric, ATB, form P, 2300 volt or 550 volt, 12 pole, 600 R.P.M.
- 1 50 KW. Ft. Wayne, TRB, form B, rev. fld., 240 volt, 1200 R.P.M.

Also smaller sizes.

## Direct Current Direct Connected Units—250 Volts

- 1 350 KW. Crocker Wheeler, type CCD, compound wound, 10 pole, 130 R.P.M., dir. conn. to 24-in. x 33-in. Buckeye non-condensing engine.
- 1 250 KW. Westinghouse, 150 R.P.M., dir. conn. to 16-in. and 31-in. x 27-in. Erie City, horizontal, tandem condensing engine.
- 1 200 KW. Westinghouse, 190 R.P.M., dir. conn. to Harrisburg 4-valve, tandem compound engine.
- 1 150 KW. Westinghouse, 160 R.P.M., dir. conn. to 13-in. and 25-in. x 24-in. Erie City, horizontal, tandem condensing engine.
- 2 150 KW. units, each consisting of 275 KW. General Electric, MP, 6 pole, 270 R.P.M., dir. conn. to one 14½-in. x 16-in. Payne engine.

Also smaller sizes.

## Direct Current Motors—250 Volts

- 2 175 H.P. Western Electric, L-5-B, compound wound, 525 R.P.M.
- 1 110 H.P. General Electric, CL-B, compound wound, 600 R.P.M.
- 3 75 H.P. Crocker Wheeler, CCM, comp. wound, 530 R.P.M.
- 3 60 H.P. Crocker Wheeler, CCM, comp. wound, 835 R.P.M.
- 1 60 H.P. Crocker Wheeler, CM, shunt wound, 830 R.P.M.
- 1 60 H.P. General Electric, DLC, shunt wound, 700-800 R.P.M.
- 1 55 H.P. General Electric, CL-A, 845 R.P.M.
- 1 59 H.P. Westinghouse, type S, comp. wound, 950 R.P.M.
- 1 50 H.P. Westinghouse, type S, shunt wound, 825-1150 R.P.M.
- 2 40 H.P. Western Electric, SNI, shunt wound, 525 R.P.M.
- 1 40 H.P. Western Electric, GM, shunt wound, 800 R.P.M.
- 1 30 H.P. Crocker Wheeler, shunt wound, 770 R.P.M.
- 2 25 H.P. General Electric, type MP, 1100 R.P.M.
- 2 25 H.P. General Elec., CL-B, shunt wound, 725 R.P.M.

Also smaller sizes.

THE FOREGOING IS, OF NECESSITY, A VERY CONDENSED LIST OF WHAT WE HAVE TO OFFER.

SEND FOR OUR COMPLETE LIST OF ALTERNATING AND DIRECT CURRENT GENERATORS AND MOTORS, ENGINES, AIR COMPRESSORS, CONTRACTORS' MATERIAL, ETC. UPON REQUEST WE SHALL BE GLAD TO PLACE YOUR NAME ON OUR REGULAR MAILING LIST.

## MACGOVERN & CO., INC.

FRANK MACGOVERN,  
Pres.-Gen. Mgr.

JOHN MAYER, Jr.,  
Vice-Pres.-Treas.

114 Liberty St., New York City

Phone 3375-3376 Rector



# Good Light in the Home

Good light prevents eye-strain and ill health and protects young eyes against premature glasses.

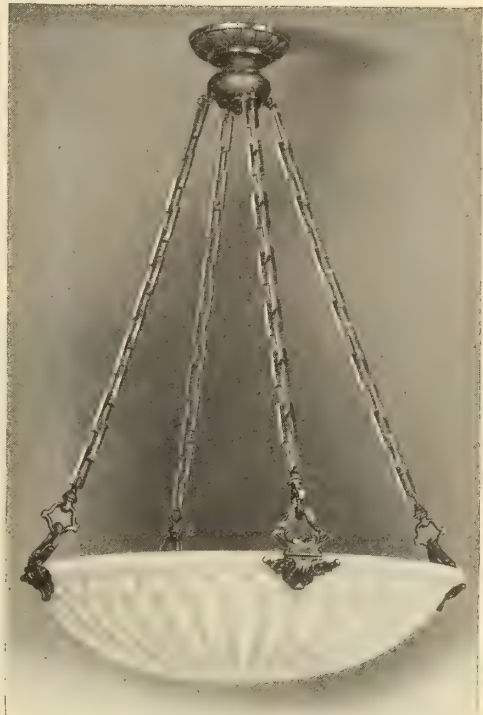
Good light brings comfort and cheer during the social evening hours, and enhances the beauty of the surroundings.

Good light is cheerful, easy on the eyes, comfortable to read by, work by and live in.

## Macbeth-Evans Lighting Equipment

*(with Alba and Decora Glassware)*

Alba and Decora Globes and Shades on Macbeth-Evans fixtures are beautiful, get more and better illumination from the current, diffuse and direct the light where it is needed, and turn the harsh, brilliant glare of Tungsten lamps into a soft agreeable illumination, and make good light cost less (less current) than poor light.



Macbeth-Evans Fixture with Alba Bowl  
—gives better and more agreeable light.

## Three things that help Dealers sell Macbeth-Evans Lighting Equipment

1. Quality—Macbeth-Evans Fixtures and Alba and Decora Globes and Shades are products of the best material and most careful workmanship. Macbeth-Evans quality has become a tradition.

2. Advertising—Throughout the land people know Macbeth-Evans lighting equipment. Carefully directed publicity keeps the public in touch with Macbeth-Evans.

3. Service—Not content merely to manufacture excellently, we maintain an Illuminating Engineering Department to plan installations correctly and efficiently.

Macbeth-Evans Lighting Equipment is the kind to sell. Write for portfolio.



**Macbeth-Evans Glass Company, Limited  
Toronto**

Macbeth-Evans Glass Company, Pittsburgh



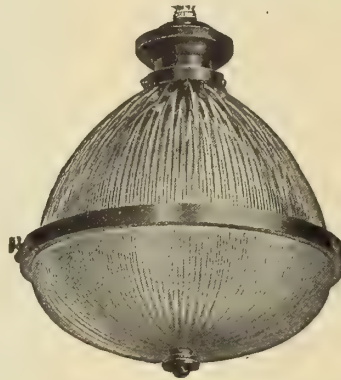
# Every One a Good One

A design and a price for every need, for Inside or Outside, for Streets, Stores, Factories, Restaurants, Theatres, Offices, Public Buildings, Railroad Stations, Yards and every place in need of better lights.



## Commercial Bell

The same fixture is used with 400, 500, 750 or 1000 watt lamps, but for the two smaller lamps the socket is dropped down into a lower position. Order by the numbers in the table.



## Holophane-Realite

The Holophane-Realite has a clear Holophane Prismatic top and a satin finished bowl, smooth on the outside but with a sunburst of prisms inside. Ventilation through the band and canopy.



## Semi-Indirect

Lighting Units Nos. 07200 and 07300 are furnished with a Holophane Prismatic Glass Reflector inside the outer Druid Glass Stalactite. In units Nos. 07210 and 07310 no Holophane Prismatic Reflector is used but the indirect light of the unit decreases greatly.

# CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office Toronto District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

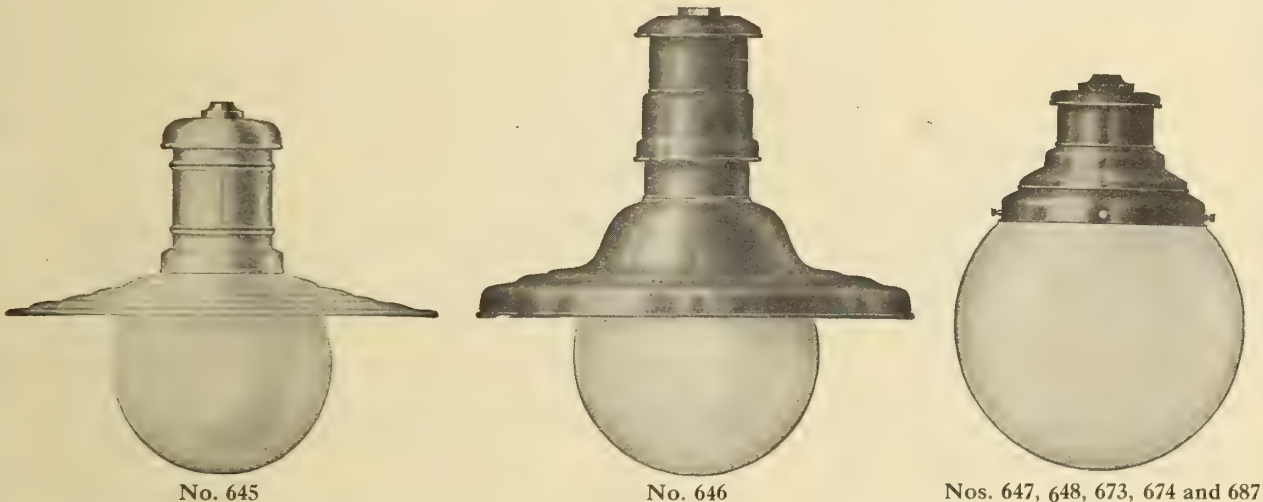


# High Candle Power Illumination

## On a Simple and Scientific Basis

From the merchandising standpoint, you have never before been able to get the same range of reflector possibilities for both inside and outside lighting at the prices and with the efficiencies that are offered in this Holophane series.

### Outdoor Fixtures



No. 645

No. 646

Nos. 647, 648, 673, 674 and 687

**No. 645** is a "white way" unit. It is white porcelain enameled inside and outside with two gold bands on the extension. The top is tapped for  $\frac{1}{2}$ -inch pipe. It is sturdy and weatherproof. The opal ball is 10 inches in diameter, with a  $\frac{3}{4}$ -inch hole in the bottom. Nos. 649 and 699 are similar in construction to 645 but less elaborate and less expensive.

**No. 646** consists of a porcelain enameled weatherproof fixture complete with Mogul socket and a 10-inch diffusing opal ball. It is tapped at the top for  $\frac{1}{2}$ -inch pipe suspension. Adequate ventilation is provided.

**No. 648** consists of a specially ventilated fixture and a 12-inch opal glass ball with a  $\frac{3}{4}$ -inch hole in the bottom. The top is tapped for suspension from  $\frac{1}{2}$ -in. pipe. It is weatherproof and can be used outdoors. No. 647 is like No. 648 but a small porcelain reflector is used inside the fixture to add to the efficiency of the unit.

# CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: Toronto. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert



# SUNBEAM MAZDA LAMPS

Made in Canada

*"I do not know much about the science of political economy, but I do know this—that when we buy goods made in a foreign country, we get the goods and the foreigner gets the money, but when we buy goods made at home, we get both the goods and the money."*

—Abraham Lincoln

Besides getting goods that are made in Canada and keeping the money in the Dominion when you buy from us, you get lamps that are superior to those imported into Canada.

Sunbeam Mazda Lamps are more ruggedly made, and give a better light—a light that is Canadian.

Sunbeam Mazda Lamps are made by Canadian labor in a Canadian factory in Canada—and they are cheaper, quality considered, than those of foreign manufacture.

Let us prove the quality of our goods.

**Send a trial order.**

## The Canadian Sunbeam Lamp Co., Limited

*Main Office and Factory:* TORONTO

*Branch Warehouses:* MONTREAL WINNIPEG CALGARY VANCOUVER



# We Are Ready for Your Orders

There are ready for delivery in warehouses in  
Montreal, Toronto, Winnipeg and Vancouver,  
large stocks of the well known

## LACO TUNGSTEN LAMPS

including all sizes of NITRO, PROJECTOR  
and other types of lamps we regularly list. We  
are also adding to our stocks every week.

---

---

### In These Times

when economy must be exercised LACO lamps  
should be handled as they will give your customers  
longer life, brighter light, at less cost than any  
lamp on the market to-day.

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## Canadian Laco-Philips Co., Limited

Montreal  
Winnipeg

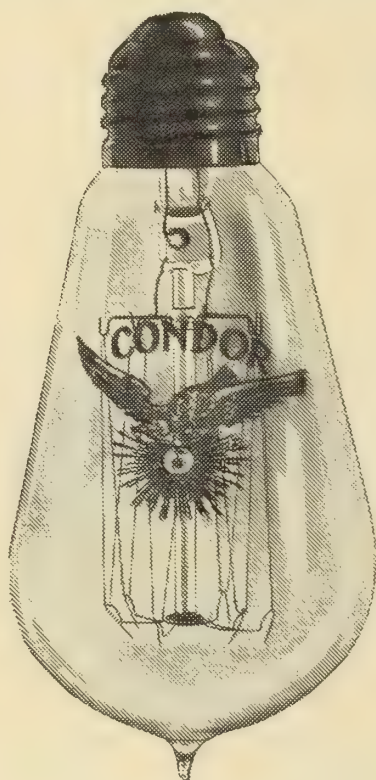
Toronto  
Vancouver



# "CONDOR"

TUNGSTEN

## LAMPS



The Lamp  
that is  
ALWAYS  
RELIABLE

# BUILT LIKE A DREADNAUGHT

"Condor" lamps are designed and manufactured to withstand long and hard service.

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**Get our prices—no matter if you want 100 or 100,000.**

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*Sole Canadian Distributors*

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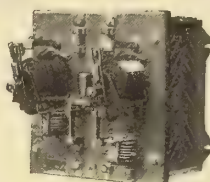
# CUTLER-HAMMER



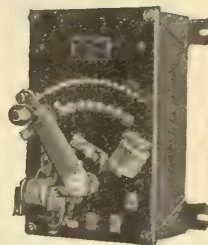
A. C. Slip Ring Motor Speed Regulator.



6-inch Speed Regulator for Small Motors.



Automatic Motor Starter.



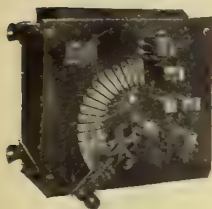
Combination Motor Starter and Speed Regulator.

## Motor Controllers For Every Motor Application

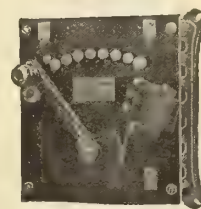
Cutler-Hammer motor controllers are made for every conceivable application of the electric motor. In fact, many applications have been made possible and many others made more satisfactory through the agency of Cutler-Hammer controllers.

If your work has to do with the installation, application or operation of electric motors, you might as well have the benefit of the 20 years' experience of our specialized engineering department.

Whether your control problem is somewhat out of the ordinary or not just put it up to the Cutler-Hammer engineers. Information and literature will be forwarded to you promptly.



Motor Starter.



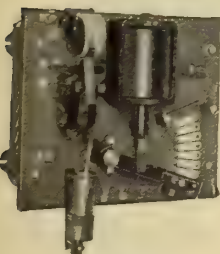
Motor Speed Regulator



Enclosed Crane Controller.



A. C. Motor Starter.



Automatic Motor Starter.

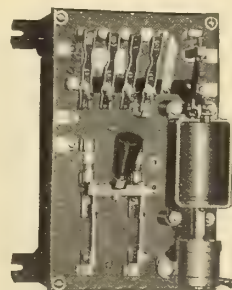


A. C. Self Starter for Single Phase and Spiral Cage Polyphase Motors.

Bulletin 9600



A. C. Starter Drum Type.



Automatic Motor Starter.

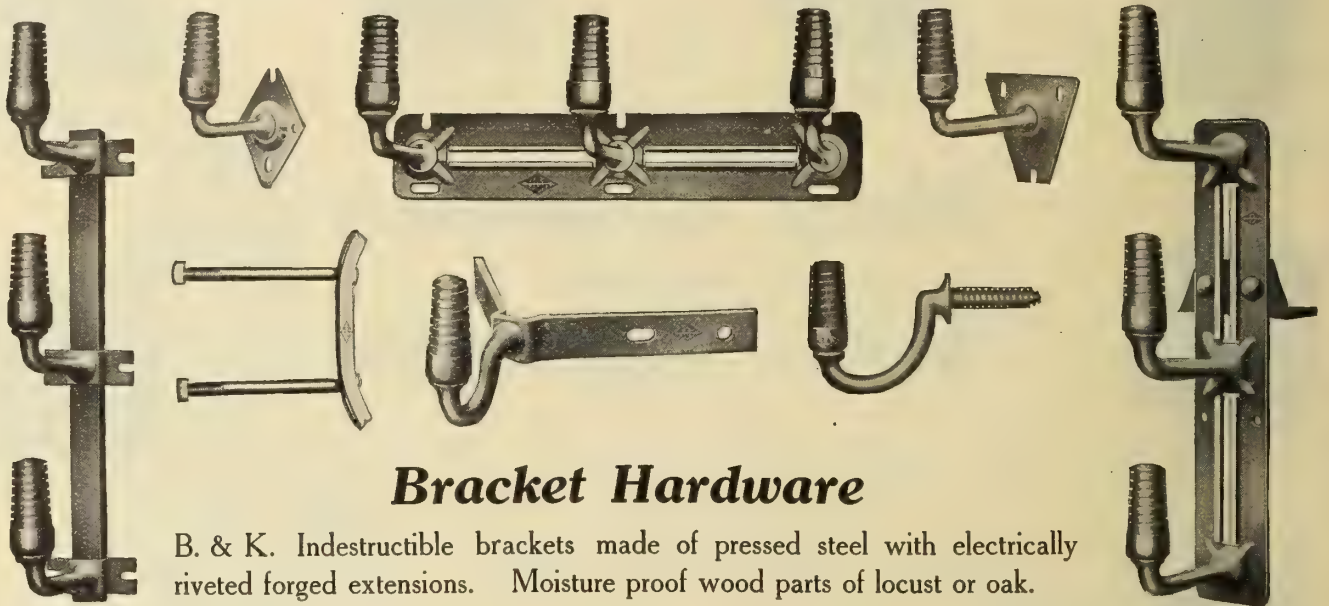
**THE CUTLER-HAMMER MFG. CO. MILWAUKEE**

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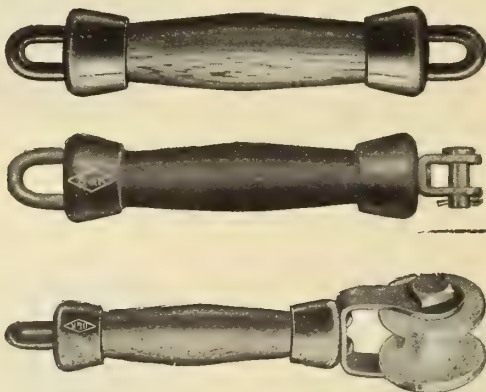
## and Pressed Steel Construction Specialties



### Bracket Hardware

B. & K. Indestructible brackets made of pressed steel with electrically riveted forged extensions. Moisture proof wood parts of locust or oak.

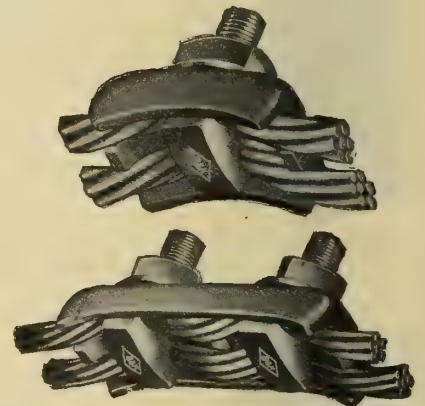
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Made in all sizes and combinations.

### Guy Clamps



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Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Terminals, Junction Boxes, etc.



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660 Watt Air Heater

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The HEATERS of QUALITY

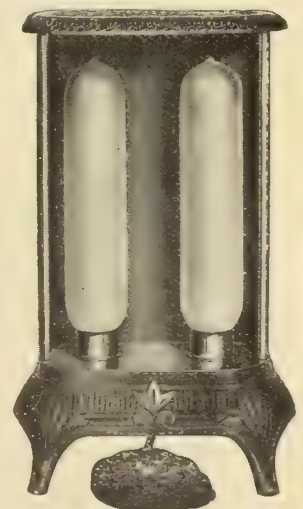
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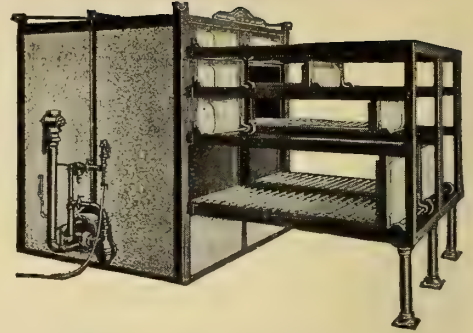


2 Glowler Radiator  
Made in all finishes



# Thorough Circulation

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Therefore, Crawford Sectional Ovens are best for japanning and for drying armatures and coils. The perfect insulation on all six sides of the oven avoids heat leakage. The Enclosed Flame Gas Burners (no open flame) operate with city, natural, producer or gasoline gas, are absolutely safe and burn just the right amount of gas to give proper conditions. The design to our ovens insures a rapid, thorough forced circulation of preheated air.

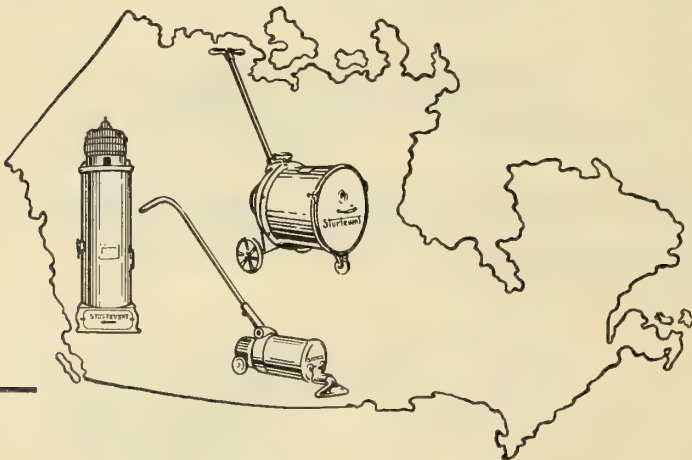
*Write today for catalog 9, describing and illustrating ovens of all types and sizes, or our folder, "Drying Out Armature Coils."*



### The Oven Equipment & Mfg. Co.

New Haven, Conn.

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NOW Made

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The Sturtevant **ELECTRIC VACUUM CLEANER** has a remarkable sale in the United States where it is known as the Western-Electric Sturtevant. It will now be sold in Canada and

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This is a very attractive proposition for lighting companies and dealers. Arrangements are satisfactory and cleaners are A-1 in every respect.

The suction is created by a motor-driven fan—that's the only moving parts—there are no gears, chains, bellows or piston to get out of order or lose suction. The Sturtevant Cleaner stays sold and each sale means a satisfied customer.

Sturtevant offers you **the only complete line** of cleaners—7 sizes of portable cleaners and 10 sizes of stationaries.

We will aid our agents with selling plans, circular matter, catalogs and sales help.

Write for full details of our proposition.

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Unequalled for controlling water levels in tanks, wells or sumps.

Absolutely weather proof and will perform their duty with reliability.

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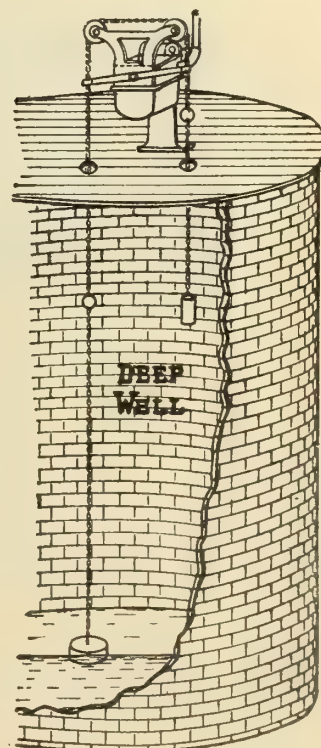
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Knobs, Tubes, Cleats,  
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Prompt  
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Best  
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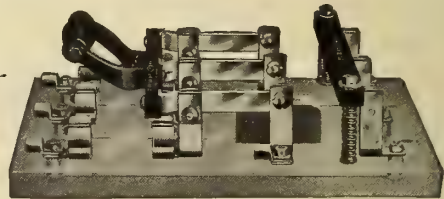
"CIRCLE T"



A. C.  
Motor



Starting Switches



The practice of starting motors with an ordinary switch is dangerous. Use the special "Circle T" motor starting switch.

The motor is started on unfused end of switch and when speed is up the knife is thrown over to the fused end. Write us for catalogue.

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Steel Cabinets and Cutout Boxes



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Do away with nails, staples, tape and other make-shift methods of holding flexible tubing



Type A

These clamps prevent any displacement of the tubing after the job has been inspected.

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**Type B**—For straight electric outlets. For fastening directly to the Header Board or joist.

**Flexible Tubing Clamps** are quickly and easily installed, and should be back of the plaster line. They have round edges to prevent cutting the tubing when bent at an angle with the clamp.



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Approved by the National Board of Fire Underwriters.

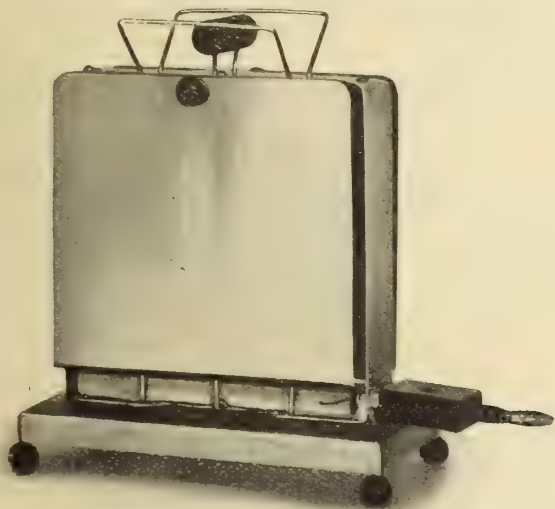
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## Here It Is RAPID TOAST-STOVE

TO RETAIL AT \$2.50



Can you beat it at the price?  
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MONTREAL TORONTO WINNIPEG

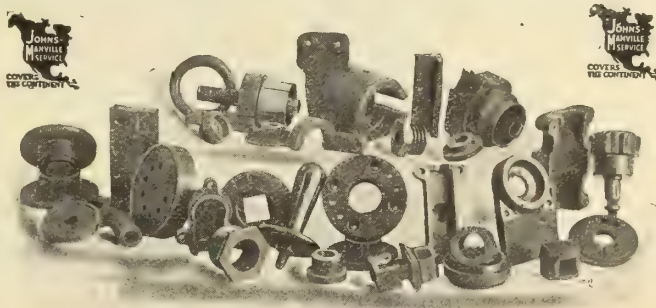
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### The insulation for hard service!

Vulcabeston is an insulation of practically pure Asbestos,—dense, strong mechanically and electrically, with high heat resisting qualities. It is not affected by expansion or contraction due to heat and cold. For motors, controllers, switches, circuit breakers, etc., it has been supreme for 28 years. Made for the hardest kind of service.

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2701

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for charging your automobile lighting and ignition battery. At night, screw attachment plug into convenient lamp socket—

In the morning your battery is ready for work.

Bulletin 10013

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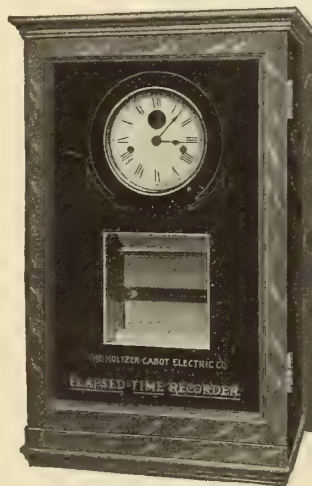


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FOR HOSPITAL SIGNALLING

and

Automatic  
Supervision  
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are fully described and illustrated in a circular recently issued.

We want you to have a copy.

Send for Special Circular 151N03

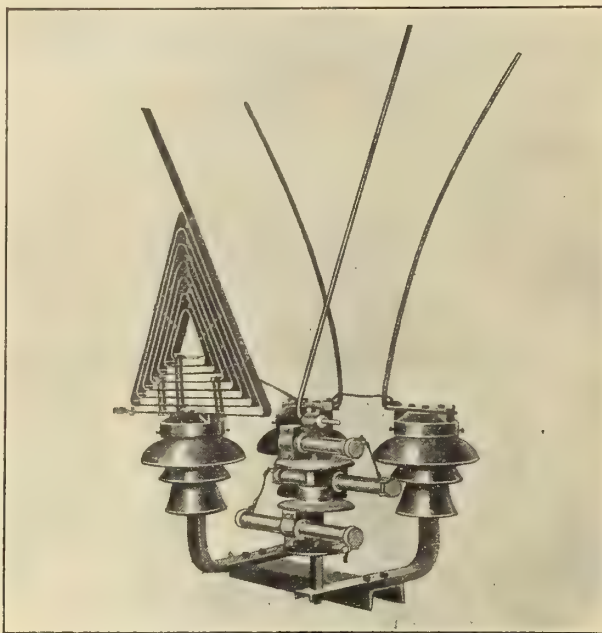
## HOLTZER-CABOT SIGNALS

Are Being Used in Many of the Finest  
Hospitals in America



THE HOLTZER-CABOT ELECTRIC CO.  
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## Lightning Arresters Burke Horn Gap Resistance in Ground

Circuit limits the flow of dynamic current which might otherwise follow a discharge to ground. The magnetic blow out aids in breaking the arc quickly.

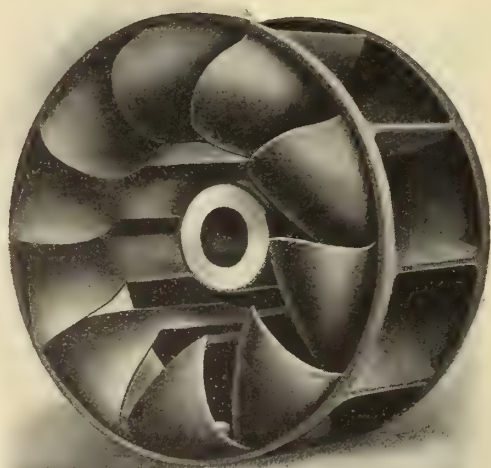
Resistance Columns so built that they may be used with Burke Arresters now operating with horns connected direct to ground.

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CANADIAN AGENCY :— The Ferranti Electrical Co., of Canada Montreal, Toronto & Winnipeg

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A normal speed Turbine of Normal Capacity. Not overgated or over-rated. Steady, Sturdy Power from Quarter to Full Gate.

**Efficiency, Durability and Genuine Satisfaction assured.**

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Established 1867



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OF TRANSMISSION  
LINE ENGINEERING  
PARTICULARLY AT  
PRESENT. LET US  
SHOW YOU HOW

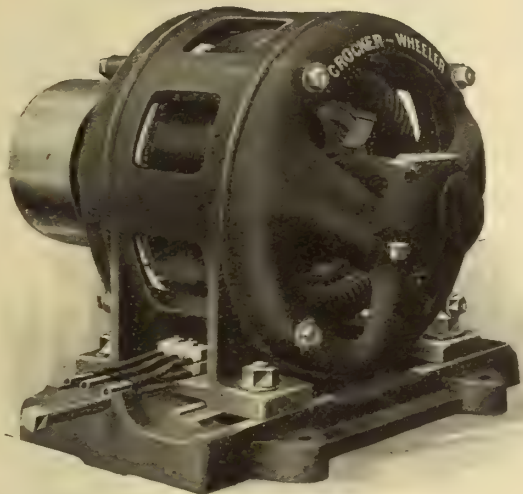
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CONDUCTORS WILL SAVE YOU THIRTY PER CENT.

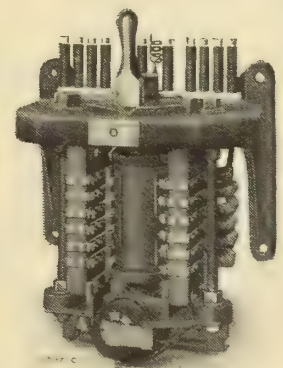


THE BRITISH ALUMINIUM CO., LIMITED  
OF LONDON, ENG.

60 WEST FRONT STREET, TORONTO



# Transformers and Motors



NOTE:—  
Our oil immersed  
No-voltage release

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# THE VICEROY ELECTRICAL ILLUMINATION SYSTEM

*Made in Canada*

British Patent No. 24243.12

Canadian Patent Applied for



The Studio of the Future

## EXTRACTS FROM TESTIMONIALS

"We are very pleased indeed with your system of lighting. It is far and away the best system of electric lighting and we have tried about four or five others."

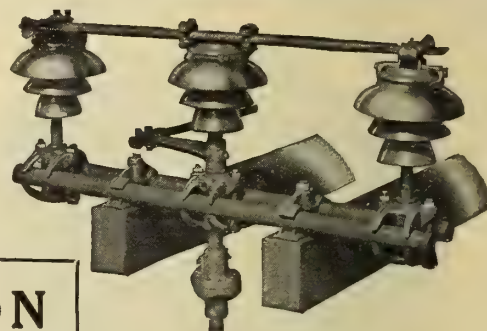
WHITFIELD COSSER

"I have used the Viceroy Light for a long time. It is always there when required. It is always the same power. It requires but little attention. I am confident that it is the light of the future. It is really daylight beautified and made certain and reliable."

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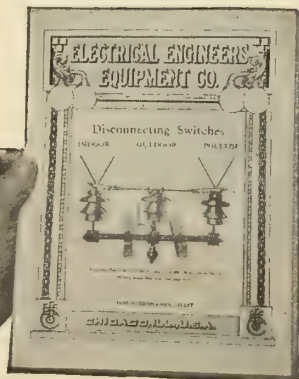
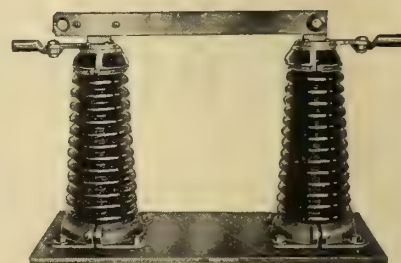
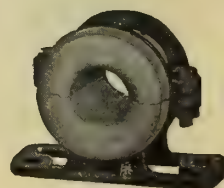
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Entered as second class matter July 18th, 1914, at the Postoffice at Buffalo, N.Y., under the Act of Congress of March 3, 1879.

Vol. 23

Toronto, October 1, 1914

No. 19

## The "Good Lighting" Season

Every year at this season, as the evenings begin to lengthen, the attention of Canadians is necessarily drawn more forcibly to the need of good illumination. Living in a comparatively high latitude, and spending, in consequence, so many more hours each day under artificial light than our neighbors to the south, it is all the more necessary, taking into consideration the evil physiological and psychological effects of bad lighting, to say nothing of the reduced quality and quantity of work we can turn out, that we take extraordinary precautions to have our illumination installations more carefully made and more scientifically installed than those countries which are more fortunately situated in the way of a larger total number of hours of daylight. Instead of leading in the matter of good illumination, however, it cannot be contended that Canada is even holding her own with many of those countries whose need is much less urgent. Our methods of illumination have been both crude and inadequate, and where others have been actively awake to the physical and industrial advantages of all the modern developments in illumination, and scientifically active in pursuing the study of the art of illumination, so that still better results may be obtained, Canada has been satisfied, except in a few isolated instances, with lighting installations, both public and private, of a type discarded by our neighbors many years ago.

It is with the hope that we may have some little influence in improving these conditions, through expressing the views of engineers and others who specialize in illumination

installations, and through descriptions of what other countries, in advance of us, are doing, that we publish each issue a section on illumination, and each year at this time, a special illumination number. In the present issue will be found articles on many topics of everyday and vital importance—factory lighting, street lighting, house lighting, glassware, distribution methods, etc. None of these are intended to cover the subject completely, but all of them, it is believed, will assist in adding something to Canadian productiveness, comfort and happiness. The value of proper illumination is each day becoming more distinctly understood; the means of providing it is already, to a very satisfactory degree, available. Is it not our duty to take advantage, to the fullest extent, and without further delay, of all that science has already accomplished? At a little later date may we not also hope to do something, by way of study and research, towards adding to the sum-total of human knowledge on this important subject?

## The Middle Course

Our Minister of Finance, Hon. W. T. White, in his recent public utterances, has voiced the exact sentiments of the more thoughtful of the Canadian people, when he counsels that municipalities, railways and big industrial concerns should steer a middle course in carrying out their programmes of expenditure in the immediate future. Mr. White evidently has no sympathy with those manufacturers and others who, at the first sign of trouble, summarily dismiss their loyal employees, and close and bar their doors, thus accentuating the very difficulties others, more loyal and sane, are endeavoring to forestall. This form of "Shylockism" ill befits those who have profited for many years by one form or another of government protection.

The middle course has already proven an eminently fair and sane one for business men throughout the Dominion to follow. A readjustment is evidently even now taking place. As Mr. White says, the first and the worst effects are gradually wearing away. Many of our industries have suffered, but on the other hand, many have been greatly quickened and stimulated. The higher prices for grain and other agricultural products will more than neutralize the shortage in amount. Increased agricultural production will be inevitable, and this has been the great need in Canada for many years back. This will help to solve the problem of the high cost of living, with its coincident evils, the overcrowding of cities and consequent unemployment. As a result of the scarcity of certain raw materials, new industries will spring up, and with the demand for manufactured products, which Europe cannot hope to supply for many months to come, Canada now has unexpectedly opened to her the means of becoming recognized throughout the world as a manufacturing centre. The first duty of every Canadian is to put forth his utmost effort to increase production and to add to the national wealth, not only that the wastage of war may be repaired, but also that the opportunities offered by the conditions which the war produces may be taken advantage of to their fullest extent.

## A Canadian Illuminating Society

In spite of tremendous advances made in the last few years, there is yet a vast room for improvement everywhere, and in Canada particularly, in what may be called the "field of proper illumination."

Past progress in the illumination art is the result of individual effort. The lamp manufacturer has produced a well-nigh perfect lamp; same with the glass manufacturer. The central station is giving far cheaper current. The contractor is wiring his buildings safely and completely. The architect is developing the decorative side, but there lacks—



co-operation. The glass man has his own idea—he wants to sell glass; the lamp man wants to sell lamps; the manufacturer of brass wants to sell brass; the contractor wants to do plenty of wiring regardless of all the others; the central station wants to sell current. But individual play has its limitations. It is team work that wins the pennant. So, if we are to advance further in Canada towards that all-important goal—correct illumination—the various units must work together.

Before they can work together, however, they must **get together**—manufacturer, architect, dealer, engineer, contractor, jobber, decorator, ophthalmologist—get together and discuss ways and means of producing better results, meet on common ground and each express his own point of view, so that the present illuminating industry, a heterogeneous and more or less chaotic muddle, may become transformed into a homogeneous, perfect unit. The need of some kind of an organization among illuminating interests was felt a few years ago in the United States, and the result is to-day a very powerful and influential society, which has been the means of improving beyond conception the standard of illumination of that country. A few, very few, Canadians have taken advantage of the opportunity of becoming members of this society and have derived very great benefit therefrom. The London (Eng.) Illuminating Engineering Society, operating along similar lines, has also proven a great success. Our apparent need to-day is a Canadian Illuminating Society where anybody interested in better illumination (which means everybody) may meet together for mutual benefit and enlightenment. The field for such a society is wide and open. The material is ample and ready to hand. Can we not have a Canadian Illuminating Society and improve illuminating conditions right away?

### The Lamp Situation and the War

One of the most inconveniencing possibilities of the European war would be a shortage in incandescent lamps, though danger in this respect appears to be remote. Lamp manufacturers of North America have, it is true, been more or less dependent for their supply of glassware on Germany and Austria, which countries have long been recognized as the seat of the glass-blowing industry. This continent has been growing more independent, however, in this respect, and in recent years the quantity of home blown glass has been greatly increasing. Indeed we understand that at least one large lamp factory in the United States blow practically all their own bulbs, and the exigencies of the present situation will no doubt serve as a general stimulus to this phase of the glass industry.

A somewhat unfavorable item in the glass situation is the fact that certain of the chemical ingredients required in the manufacture of the various kinds of glass have also been imported from Europe; to what extent this loss can be made good from other sources has yet to be determined. Another item to be considered is that the blowing of glass is an art not easily or quickly acquired. The continentals have become perfect in this art through centuries of painstaking, intelligent concentration, so that the influences of heredity are added to the natural adaptability of the German and Austrian glass blower. For these reasons, it is doubly difficult to duplicate this merchandise in Canada or the United States, and impossible to do so except at greater cost.

Fortunately, however, a very large percentage of our lamps have been coming from Holland and England, and all orders placed with these countries are, so far as we can learn, being accepted without hesitation. Indeed shipments are already to hand for which orders were placed since the war began. In certain quarters it was feared at first that the home

demand in England, deprived of the imported supply, might mean the shutting off of a part of their export, and that Canada would suffer thereby. This however has not been the case.

So far as price is concerned, there is no immediate danger of any marked advance. A manufacturer here and there has added a cent or two per lamp to cover extra contingencies, but the price to the consumer in all cases remains the same, and, in most cases, to the dealer. Taken altogether, therefore, the incandescent lamp situation in Canada remains practically undisturbed by the European war.

A prominent Canadian manufacturer discusses the situation as far as his company is concerned, as follows:—In the past we purchased very few lamp bulbs of foreign manufacture, as from past experience we found that we could not get the bulbs uniform, and in order to get a first class article we have been purchasing the greater part of our bulbs from United States manufacturers at an increased cost over those of foreign make. To take care of our regular heavy fall trade we have on hand a large quantity of bulbs and a fair stock of all staple types of carbon and mazda tungsten lamps sufficient to take care of our regular trade.

We have a large stock of tungsten metal and we do not anticipate any difficulty in getting a further large supply. Tungsten is used to a great extent in the manufacturing of steel and can be purchased in large quantities from practically any country in the United States. I also understand that it can be secured in Canada.

We are doing our own refining and also drawing our own wire. **We do not anticipate any difficulties in securing raw materials necessary for the manufacturing of various types of incandescent lamps.**

We a short time ago advised all of our contract customers that we are prepared to furnish them with the full quantity of lamps called for on their contract, at no advance in price. We will no doubt be called upon shortly to furnish large quantities of lamps to take the place of those formerly imported from foreign countries. Having recently imported from foreign countries. Having recently made large additions to our plant, doubling our capacity, we are prepared for a very large increase in business. Our busy season is now close at hand and we are prepared to give our usual efficient service to all of our old customers and are making arrangements to give the same efficient service to any new trade we may be favored with. In order to do this it may be found necessary to run a night shift. With this in view we are arranging to train new help.

We are indebted to the office of the Chief Trade Statistician through Mr. F. C. T. O'Hara, deputy minister of the Department of Trade and Commerce, Ottawa, for the following information regarding the importation into Canada of material required in the manufacture of incandescent and arc lamps.

#### Imports of Undermentioned Goods into Canada

(Year ended March 31, 1914)

Incandescent lamp bulbs and glass tubing for use in the manufacture of incandescent lamps and mantle stocking for gas light:—	
From Austria-Hungary ... ..	\$13,000
Belgium ... ..	40
France ... ..	1,824
Germany ... ..	4,128
United Kingdom ... ..	1,491
United States ... ..	110,049
Total ... ..	130,532
Metallic elements and tungstic acid when imported by manufacturers for use only in their own fac-	



tories in the manufacture of metal filaments for electric lamps:—

From Austria-Hungary ... ..	\$ 1,748
United Kingdom ... ..	28
United States ... ..	44,120

Total ... .. 45,896

Electric light carbons and carbon points of all kinds:—

From Austria-Hungary ... ..	\$ 587
Belgium ... ..	222
France ... ..	633
Germany ... ..	43,308
Switzerland ... ..	2,491
United Kingdom ... ..	5,247
United States ... ..	37,368

Total ... .. 89,856

The imports from Germany alone to Canada of lamps of different kinds also follow:

Classification	Number	\$
Arc lamps ... ..	164	2,618
Metal thread lamps ... ..	502,533	130,186
Electric incandescent lamps, N.E.S.	296,535	25,704

### Gas Filled Tungsten Lamps in Chicago

On August 18th a circuit containing 240 4-ampere 75-watt series nitrogen-filled tungsten lamps was put into operation in the Ravenswood district, Chicago. On August 27th a circuit of 132 20-ampere 300-watt series nitrogen-filled lamps was turned on in the south side district. The latter is claimed to be the more noteworthy installation, because all indications seem to show that the performance of these lamps will fully equal, if not exceed, in all respects, including actual cost and equivalent illumination, the results obtained with the flaming arc lamps, which have been the standard street lighting units in the city of Chicago.

Within the past two weeks seven additional circuits have been put in service, bringing the total number of 300-watt nitrogen-filled lamps in use on September 8th to 728. It is said that more are to be added from time to time, so that, before many months, Chicago will be using up to 15,000 of these new units.

The fixtures with the nitrogen-filled lamps closely resemble the flame arc equipment in appearance. Instead of the arc mechanism there is a compensator furnishing 20 amperes to the lamp from the 10 ampere line circuit. The compensators have an extra tap to permit their use on 6.6 ampere circuits, the lamp current in this case to be 20 amperes also. The outer diffusing globe is of Alba glass. Within this globe some of the lamps are being equipped with a special refracting globe made of two cup-shaped prismatic glass globes, sealed together with the prisms on the inner surface to protect them from dust, the outer surfaces being smooth. This refractor is intended to give a greater lateral distribution of light.

Service is from overhead wires. The lamps are mounted on tubular steel poles, with the centre of the lamp 22 feet above the street surface. For cleaning and renewals the lamps are lowered to the ground, the lowering rope passing up through the pole after the lamp attendant has attached an extension rope. In the later installations the lamps are placed from 160 to 250 feet apart, depending upon the requirement of the street.

It is said that the light furnished by the new lamps is very pleasing in color and steadiness. The outer globe is uniformly luminous and gives a nearly white light. The density of the globes and the height of the lamp are sufficient to reduce the glare to a minimum. The light is very

steady compared with the flame arcs. Tests have not yet been made to distinguish the relative distribution effects with and without the special inner refracting globe. The new lamps give an average maximum of 600 c.p. with 300 watts consumption. Tests shows that, in the earlier part of their life, the c.p. increases slightly, and this gradually diminishes, so that the average c.p. during rated life shows very little variation from the normal rating. Taking into consideration electrode and lamp renewals, cost of trimming and cleaning, cost of current, etc., it has been found by the city engineers that the cost of maintenance for the two types of units (mazda and arcs) will be practically equal for equal illumination, if the nitrogen lamps have the 1,000 hours of rated life which the manufacturers guarantee. A prime advantage claimed on behalf of the new lamps is that the initial investment per fixture complete is only about one-half that of flame arcs.

### Electric Vehicle Convention

The fifth annual Convention of the Electric Vehicle Association of America will be held, in Philadelphia, October 19, 20, 21.

During the past year twelve sections have been added to the two existing at the time of the fourth annual convention held last year in Chicago, bringing the sectional representation up to fourteen, so that the reports of the various sections—distributed all over the country—will prove of unusual interest. Doubtless plans will be formulated at the convention which will enable the sections to make even greater advance during the coming year, and the reports and discussions of section activities should be one of the bright spots of the convention.

The following list of papers will be presented:—

"Progress of the Electric Vehicle," by James H. McGraw.  
 "Electric Vehicles in Parcel Post Service," by William P. Kennedy.

"Electric Vehicle Charging," by J. F. Lincoln.

"Special Applications of Electric Trucks," by F. Nelson Carle.

"Electric Vehicle Performance," by Robert B. Grove.

"Effects from the Utilization of the Kinetic Energy of an Electric Vehicle," by T. H. Schoepf.

"A Wider Dissemination of Electric Vehicle Information," by T. I. Jones.

"Calculations of Electric Motor Characteristics and Prediction of Vehicle Performance," by A. A. Nims.

"Educating the Public in the Field and Use of the Electric Vehicle," by F. C. Henderschott.

"Power Wagon Operation in Central Station Service," by W. A. Manwaring.

"Electric Fire Apparatus," by Chief George S. Walker.

"The Design and Performance of Electric Vehicle Motors," by H. S. Baldwin.

Symposium—"The Electric Industrial Truck," by manufacturers.

"The Cost of Electric Vehicles," by George H. Kelly.

"European Development of the Electric Vehicle Industry," by P. D. Wagoner.

"Constant Potential Systems for Charging from Motor Generators," by H. P. Dodge.

"The Motor Truck in Traffic Congestion," by Lieut. William D. Mills.

The Moloney Electric Company of Canada, Limited, have vacated the office they have been occupying in the C. P. R. Building and have taken new offices in the Traders Bank Building. The general sales office for Canada is now established at the above address.



# The Illumination of a Modern Factory

**Warrants Very Careful Consideration—Location of Equipment, Degree of Illumination for Various Purposes and Physical Effects are all Determining Factors**

By Mr. F. R. Ewart

The illumination of a modern factory is a problem which warrants very careful consideration. It is no longer possible to ignore the fact that proper lighting has a very definite influence on the way in which work is turned out and this influence is a matter of dollars and cents to the manufacturer in the final analysis. The physical effect on the workers of eye strain due to glare, or of vitiation of the atmosphere from burning illuminants, will show up immediately in the quantity and quality of the work they turn out. The closely allied psychological effects of comfort or discomfort will naturally still further magnify these results. It is not possible within the scope of this article to consider these interesting matters in detail, but it is hoped that the suggestions may serve to emphasize the importance of the question.

The old method usually employed consisted merely of putting an outlet in each bay and experimenting afterwards to find some equipment that would give the required results. Unfortunately it is often found that many outlets are not in the right place and that units of the right size greatly overload the circuit. If the work is in conduit it will frequently be impossible to adapt the system satisfactorily. If, on the other hand, open wiring has been installed, it may be possible by considerable cutting and tapping to fit things up so that they "will do." In most cases the resulting arrangement is sloppy and often positively dangerous. The efficiency obtained by such methods, as judged by current consumption will rarely be up to the mark. The only proper way to get the best results is to consider the illumination scheme in detail at the beginning and then put in the wiring necessary to operate the installation.

## Determination of Requirements

The first essential in the determination of requirements is proper knowledge of the nature and disposition of the factory equipment. In some cases it may be sufficient to indicate roughly the conditions existing on each floor or portion thereof. As a rule, however, it is advisable to make complete lay-out plans of the whole factory. It is obvious that stock rooms and general open spaces will not require as high a degree of illumination as areas over which actual work is being done. Then, too, the requirements for different kinds of work will vary over quite a wide range. Operations on large objects conducted at a slow rate may be well served by a moderate lighting intensity, which would be quite inadequate for fine work put through rapidly. The contrast between a large boring mill and an ordinary sewing machine will serve to illustrate this point.

The degree of illumination required for various purposes is determined largely by experience, under the guidance of established data.

The next point for consideration is the question of interference from other equipment. Sprinkler systems, steam and water pipes, shafts, belts, etc., all have their place in a modern factory. It is only in minor details that these features can be made to show any consideration for the lighting equipment. To a very large extent the lighting will have to be arranged to look out for itself.

Lastly, thorough consideration must be given to the physical and psychological effects above mentioned. An installation which presents a dazzling glare in every direction may

produce poorer results than the old-fashioned fire fly system of drop cords so familiar a few years ago. A system of large gas arcs may provide excellent lighting from a photometric standpoint, but when installed in a large factory with low ceilings and indifferent ventilation, they may play a large part in making the workers dull and drowsy in the middle of the afternoon.

## Meeting Requirements

After the requirements have been carefully determined, it is not such a very difficult problem to fulfil them. It must be remembered that efficiency is the real determining factor. The question of aesthetics can not be considered to any serious extent. It is, therefore, a much simpler problem than store illumination, for instance, where the twin questions "What will it do?" and "How will it look?" are absolutely inseparable. In the case of the factory, it is only necessary to decide upon the easiest and most economical way of meeting the pre-determined conditions.

Fortunately we have available a very wide variety of equipment, so that it is hard to find a case which cannot be solved by some standard article on the market. Then, too, the choice already at hand is regularly being supplemented by new lines, thus making it continually easier and easier to find what is wanted.

It may not be out of place to say a few words in regard to proper illumination data. Most of the reliable manufacturers can furnish complete photometric curves of every variety of equipment they handle. In many cases these are thoroughly authenticated by the fact that they are prepared by independent laboratories of wide répute. Such information is absolutely essential to the illuminating engineer. He cannot afford to accept the bald statement that it is a first class reflector and has given good satisfaction in so-and-so's factory. He must know just how good and how he must handle it to get the best results. The best reflector in the world may prove worthless if improperly installed. Since he proposed not to guess at the question, but to work it out on a scientific basis, he must have full and accurate information on a product or he cannot use it.

In settling on the equipment to be used the question of location enters so intimately into the problem, that by the time a satisfactory solution has been obtained the matter of locations has been solved also. In some places they will be on quite short spacings. In others they will be separated by comparatively long distances. The exact location of many outlets may be partially affected by the consideration of other nearby equipment.

Having selected the units and located them, nothing more remains than the consideration of control. In many cases several units serving the same work may be required altogether or not at all. Under such circumstances these units are best grouped on a single switch. In other cases it may be necessary to control individually. With the control decided upon, it is a simple matter to group the units properly into circuits and thereafter complete the balance of the wiring system required to handle the complete installation.

## Economics

With the system thus worked out down to its final details, it is in order to make a final survey from the economic standpoint. From this it must not be inferred that this all



important consideration has been put aside during the work of solving the problem as outlined above. It is an insistent dictator on every point that comes up. The final net results, however, can only be determined accurately after the other work has been completed.

The efficiency of the installation is first judged by the limitation of the total connected load within reasonable bounds. This may be expressed in terms of kw., per thousand square feet. But this figure may vary fairly widely depending on the average intensity of illumination that has been required. Then, if this quantity be divided again by the average intensity in foot candles obtained throughout the factory, the result, which may be expressed as kw. per ft. candle per M. sq. ft. will represent an absolute measure of the efficiency of the installation. This should come out at about 0.2 in a case where the efficiency question has not been over-ridden by other considerations.

From the efficiency determined in this way and the known cost of current, we may determine the operating cost for the whole factory and on a basis of cents per hour per ft. candle per M. sq. ft. Then a careful estimate of the value of the installation will give the capital cost, from which may be deduced the annual fixed charges in interest and depreciation. This last item will probably be determined more from the standpoint of obsolescence and length of tenure than on a basis of the full useful life of the equipment.

The third element of cost to be taken into consideration will be maintenance. In an installation of incandescent lighting, where the materials used throughout are of the best grade, maintenance should not amount to much more than the cost of lamp renewals alone. With a more elaborate equipment such as arc lamps, the maintenance problem may assume a more complicated aspect. The sum of the three items, current, fixed charges and maintenance, may be expressed in terms either of annual cost or total cost per ft. candle per hour per M. sq. ft. For example, with an efficiency of .2 kw. per ft. candle per M. sq. ft.; current at  $3\frac{1}{2}$  cents per kw.h.; an installation cost of \$10 per outlet; allowing 6 per cent. interest and 10 per cent. depreciation; an average operation of 50 hours per month; and tungsten lamps at prevailing prices—the total cost per ft. candle per hour per M. sq. ft. would run about 1.5 cents. Since the fixed charges amount in this case to about one-third of the total, it will readily be seen that the amount of use will widely affect the net result. In any case the figures obtained by these methods will give a reliable means of judging the value of the work accomplished.

## Elec'l Trade in Western Canada

By Mr. R. H. Mainer

I have heard it remarked during the last sixty days, "that the electrical business in the West was working overtime to keep alive."

The universal tightening of the money market during last winter, the "marking time" period in anticipation of a busy fall, and then the announcement of only a half crop,—capped by Canada going to war with Germany,—has certainly affected all kinds of business in Western Canada, the electrical as much, but probably not more than any other.

During the last five years a rapid growth of things electrical has taken place, so much so that manufacturers in Eastern Canada, the United States and even Europe have directed special efforts to participate. Encouragement has been given to firms and individuals to push for business in every way possible and numerous western commission agents, jobbers and salesmen have sprung into prominence as a result. Everything favored individual effort, and excepting in the case of a limited number of firms of reasonably strong

financial standing, considerable business has been carried on, mainly at the expense of the principals and not of the agent.

The last twelve months has steadily worn down the resources of this large but poorly equipped section of the business community, and as a result many names of individuals which have flourished for a time are rapidly disappearing and this is as it should be. Under the best of circumstances these trades would have failed in time, and whilst the sudden breaking down of a number seems to point to an unhealthy state, yet it is driving what good business there is still to be done into safer and more permanent quarters.

There is little complaining to be heard from the business houses of good financial standing, although it is true enough that they feel the loss of the booming western optimism which is so characteristic.

Retrenchment in expenses, curtailing in buying and a general tendency to cut off loose credit is being carried to the limit, and the effect has already steadied current business affairs until the element of doubt as to the future is practically eliminated. The old days when twenty-five salesmen would gather in a town of less than five thousand population, and with lavish expense money try to outdo each other in every manner of extravagance to win a prospective customer, have gone the way of the buffalo and the red man, and the trade in general heaves a sigh of relief and is glad.

Personally, I have had recent visits from representatives of United States firms, who come to this city two or three times each year, and they report the outward appearance of the city of Winnipeg, in so far as general business is concerned, as better than the cities to the South. We are turning out hundreds of men for active service in the present war, and yet all the stores appear fully manned and the boss goes about with a cheerful countenance that surely belies many tales of Western depression, which come in from the outside.

From all central western points the better class dealers are ordering, small orders, but often. Salesmen on the road report considerable building, which has been crawling slowly for some months, as being hurried to completion. It is not safe to forecast the future, not until the German war troubles have been wiped off the map, but for the few months remaining of this year the feeling is general that a fair average business will be transacted and, with the advance in all prices which has developed, probably more than average profits will be shown.

It never has paid to gamble on the credit in Western Canada and now it could not even be called a gamble, but a sure loss, and more than ever it will be a necessity for eastern and foreign producers of goods to depend on the representative and substantial jobbers and dealers now situated in the West, and who are specialists in the conditions existing. The small commission man, the itinerant peddler of a few lines, and the petty dealer in a small community must give place to the better equipped concerns, who spend good money from exacting shareholders to buy and warehouse stocks of goods to be served out at the discretion of a well organized credit department.

The West, once a runway for all kinds of cheap material, most of it of foreign manufacture, has at last decided that products nearer home are better, and the co-operation of their places of supply more easily obtained when within a few days' journey, and more general good will doubtless be experienced.

Mutual patience and co-operation between East and West is the thing most needed at present, and those who realize this now will profit the most when trade resumes its normal position again.



# Influence of "Glare" in Poor Illumination

## A Condition Easy to Recognize but Difficult to Overcome—Causes Eye Strain and Defective Vision

By Mr. E. N. Hyde

Probably one of the most frequently used terms indicating a condition of bad illumination is the term "glare." There is no question in the mind of anyone that such a thing as glare exists, and that it is an evil greatly to be avoided. Probably the public suffers more from glare than from any other fault in installations of artificial lights. More harm probably is done to our eyes because of glare than any other one thing connected with artificial illumination. Millions of people are daily—or more appropriately, nightly—having their eyes subjected to strains, and their vision baffled by "glare," and it goes on week after week, month after month, and year after year without protest from the public, without restriction by the authorities, and without widely spread protestations from the oculist and medical fraternities who best of all know the havoc glare is doing in the way of damage to the visual organs of humanity.

Not infrequently some enterprising newspaper or periodical describes an aggressive business man's sign as being wonderfully bright and unique in design, but ignores altogether the unwholesome presence of glare that has been added to the altogether too many existing cases that literally shine, so conspicuous are they on the main thoroughfares of every large town and city of this Continent.

Glare, however, is an evil that also exists indoors, and the installation that totally eliminates its to be dreaded effects, is so rare that it is a matter that eloquently supports the claim that some concerted action on the part of educators, progressive central station men, boards of health and societies of medical and ophthalmological graduates should be taken to promote good illumination. That no such action exists in Canada is discouraging, and displays the small success that has been attained by those, who, in an effort to improve artificial lighting and make it more healthful, have been trying for years to arouse the public to take active interest in the subject.

Glare may seem to one upon casual examination to be a simple phenomenon. A study of it, however, soon disabuses the mind of this mistake. It is like electricity, a something which exists with plenty of evidence of what it does, but cannot be put into exact terms, has no chemical formula to indicate its ingredients, and defies an exact pathological explanation for want of more information. It is physiological, and is without standard measurement. By altering conditions it can be made to exist or not to exist at will, without change in the artificial light, but by a change in the quantity of sunlight admitted to the eye, simultaneously with the artificial light. Sunlight itself can reach the eye, so as to produce glare, and the eye itself automatically protects itself within a wide range, against a condition of glare, often at the expense of good vision. Glare sometimes disappears when there is more light flux present than when a lesser amount in the shape of a beam is in range of vision. A few examples may serve to illustrate. A room may be well and comfortably lighted by a large window through which daylight pours. If a black opaque curtain be completely thrown over the window, so as to exclude all light, except that permitted to enter through a small hole in the curtain provided for the purpose, the beam shining through this hole will cause glare, if the eye is placed so as to intercept it, but this beam is no brighter than the light entering when the window was uncovered.

A yellow flame arc lamp hanging low in front of a mov-

ing picture theatre is an abominable source of glare at night, but when burning in full daylight looks low in luminosity, and the eye that was blinded by it at night feels no discomfort in broad daylight. The white looking nitrogen high efficiency incandescent lamp, rich in green and violet rays causes us to close our eyelids if we view it at night, but we would be likely to walk by the same lamp at noon hour without even noticing that it was glowing, if it happened to be burning at a street corner. If by chance we did observe it in full daylight, the filament is markedly yellow, by contrast.

These phenomena would suggest that the admixture of sunlight with artificial light is a cure of glare, yet the glare effect of looking at the sun is ruinous to the eye, and the glare of reflected sunlight from the snow is the cause of snow blindness. This leads us to study the affected member, and we find some very peculiar activities in the eye itself. It would be out of scope of this article to describe these peculiar happenings in the eye; they are complex and technical, demanding the treatment of the ophthalmologist's pen, so I omit any reference to them, further than to say that a great deal has been written on the subject. Enough, we hope, has been given to indicate that glare is a complex problem, and has many sides to it. There are some interesting data, however, on ways of eliminating glare, and if put into practice, will help largely to improve conditions that should not obtain. First of all, some interesting experiments by A. J. Sweet, member of the firm of consulting engineers, Vaughn, Meyer & Sweet, Milwaukee, Wis., disclosed that if a light source is so placed that its rays do not fall on the eye at an angle of less than 25 degrees to the axis of vision, the ability of the eye to discern detail (visual acuity) is not impaired. So if lights in a room are placed high the eye can look at a picture placed on the wall considerably higher than the height of the observer without the detail being obscured. Poor vision of the picture results when a region of the retina is over stimulated as happens when the light sources are so low that an angle formed by a line from the pupil to them, and a line from the pupil to the centre of the top part of the frame of the picture, makes, as frequently happens, an angle at the eye of less than 25 degrees. The over stimulated region has superimposed upon it the image of the picture, and the discernment of the latter is reduced in clearness by the former.

Another condition of glare is avoided by using relatively dark wall paper for several feet above the floor. Lighter wall paper may be used to fill out to the ceiling, and the consequent reflection value of the lighter hues largely retained. The ceiling, of course, can be white, or very light in color, without in any way contributing to glare, especially if it be matted. The darker band or wainscoting absorbs the greater part of the light which would be reflected by a white or light surface directly into the eye, glare resulting whether the wall be matted or glossed.

Glare from polished desk tops of desks upon which a plate glass cover has been placed, contributes a frequently observed unhealthy condition, ignored by thousands every day. Depolishing the wood varnish or covering the glass with a large blotter pad disposes of much regular reflection from local lights while some forms of semi-indirect and total direct lighting will effect a cure if general lighting only is used.

There are thousands of factory operatives working in Canada with a lamp hung directly in range of vision, and they



look past them at their work. The factory manager, who will take time to record the improvement in output, will find the increase sufficient to pay well for any investment made to provide the proper opaque shades which will send more light to the work, and keep the glaring rays of his employees' eyes.

Electric signs using high candle power lamps are often installed right in line of vision, and as one walks down the street, the sign obscures by contrast everything else, even the shop window articles on display. Coloured caps over the lamps form a permanent cure and lend novelty in the possible combinations of hues in letters or designs. Flame arc lamps which now hang so that a passer-by is nearly blinded by their glare and blinks in distress as he goes by them, will be much more effective if a shade be placed so that the light shut out of the pedestrian's eyes is reflected instead to the building front, which consequently will stand out more conspicuously than ever. Street standards are all the better for being high, and the more diffusing the glass globes about the lamps, the more acceptable they are, and it will be found too that vision is better even if the diffusing glass-ware absorbs so much that the consequent lumens are very greatly reduced. Cornu tried to prepare a table showing, in logarithmic terms, the increase of light flux to the retina by variations in the diameter of the pupil due to the contraction of the iris. He was not entirely successful in that his table would not hold for individuals, the variations in the personal equations being too great. Since then it has been shown that sometimes we can see better by decreasing the light, as would be the case if a bare electric lamp were taken down, frosted by sandblasting until it absorbed 7 per cent., and was reinstalled. More light may enter the eye notwithstanding this 7 per cent. decrease, because the enlargement of the pupil permits enough light in addition to enter, to more than offset the effect of reducing the candle power of the lamp. If this happens, the pupillary increase in area has been greater than 7 per cent., while the light was diminished only 7 per cent. by the sandblasting.

Diffusion has much to do with the performance of the eye, the light source being changed from the relatively small area of the filament to the comparatively large area of the frosted lamp bulb. The same holds true for globes that surround street lights. Sweet ascertained that certain zones about a street light contributed more to glare than others, and he recommends that the zone made by the angle of 25 degrees below the horizontal plane passing through the source parallel to the street level should have in it something to suppress the radiations as much as possible, compatible with good appearance.

Research into the cause and effect of glare is going on, and is by no means nearing completion. Physicist and oculist alike are taking part in the work, but in the meantime citizens endure glare on the streets, workmen suffer from failing vision, school children wear glasses at astonishingly tender years, and bookkeepers and clerks go home with aching heads after working over pages of highly calendered paper all day.

### Engineering Corps for the Front

The directors of the Canadian General Electric Company have raised a corps of engineers, numbering 25, who have already departed to take part in the new preparations going forward at Valcartier. According to official announcement, the company will also maintain this corps of engineers during operations. The following is the text of a brief address delivered by Mr. Frederic Nicolls, president of the company, to this corps assembled at the head office of the company on the eve of their departure for the front.

"Captain Ritchie and men of the

Canadian General Electric Engineering Corps.

In times of danger to the Empire it behooves every corporation, as well as every private citizen, to render such service as opportunity offers, and I may say on behalf of our directors that after consultation with the government, part of the service rendered and to be rendered by our company has been to raise and maintain the corps of engineers to which you belong.

You have this morning been sworn in to serve your country as part of the permanent forces, and if appearance and past performance go for anything you can all be relied upon to serve your country faithfully, and cast no discredit upon the Canadian General Electric Company which is responsible for your efficiency.

Good bye and good luck go with you."

Counting from the left the names of the engineers shown in the photograph herewith are as follows:

Back row standing—1. H. S. Elliott, 2. Charles Stewart, 3. C. Pink, 4. W. J. Swanger, 5. F. G. Jackson, 6. H. Williams, 7. E. S. Shill.

Front row standing—1. Capt. Ritchie, 2. A. T. McLean, 3. W. S. Johnson, 4. J. S. Dunlop, 5. G. Hillier, 6. C. Henry, 7. George Monaghan, 8. A. Hardie, 9. J. C. Munro, 10. C. C. Rous.

Front row seated—1. P. Foster, 2. E. Crockford, 3. H. S. McKean, 4. A. J. Palmer, 5. R. W. Nurse, 6. H. Galvin, 7. R. Bethune, 8. H. Bestard.



Corps of Engineers despatched to Europe by Canadian General Electric Company.



# New Street Lighting In Stratford, Ontario

**Nitrogen Filled Tungsten Lamps Installed—A Handsome Pendent Fixture Mounted on Trolley or Separate Poles—Much of Work Underground**

The Stratford Light, Heat & Power Commission have recently made a new addition to their street lighting system which has a number of features that are of considerable interest at this time.

The installation consists of 193 units located in the business district of the city. Without doubt it represents one of the most advanced types of street lighting on the continent and is moreover one of the first installations in which large units of nitrogen-filled tungsten lamps have been used. 500 watt, 6.6 amp. series nitrogen units have been used throughout. They are appropriately supported in a new type of pendent fixture mounted on brackets of serviceable and artistic design. The general style of brackets and fixtures is illustrated in Fig. 1 which shows the bracket mounted on steel railway poles. In certain localities there were no rail-

are 32 kw. capacity and one of 22 kw. Each transformer is controlled by a separate standard panel.

In the base of each standard is fitted a G. & W. combination absolute cutout and pothead. These devices are



Fig. 1—Brackets on railway jobs.

way poles available and it was, therefore, necessary to install a standard for lighting purposes only. This standard is shown in Fig. 2 and consists of a neat cast iron column and base with a wrought iron crook to harmonize with the other brackets, mounted directly on the top of same.

The pendent fixture consists essentially of a cast iron ventilated body having suitable ground and line insulation of porcelain, and supporting a Moonstone globe designed with very careful attention to correct illuminating properties. The globe is supported by means of a solid stamped steel ring giving a line contact and free from binding screws.

Fig. 3 is a view of the main street taken with the illumination from the new lighting at night.

The wiring of this system consists of three circuits run overhead from the main station and on the trolley poles, but where there are no trolley poles the connections to the cast iron standards are made underground with single conductor lead-covered paper cable laid in fibre conduit. The conduit is laid on a natural trench bottom and covered with 3-in. of concrete. The circuits are so laid out that two of them can be cut out at midnight and the all night service carried on one circuit.

The current is supplied from three constant current Adams Bagnall repulsion type transformers, two of which



Fig. 2—Standard for lighting only.

also fitted with a film cutout arranged to operate when the lamp is open circuited.

The work was done in a remarkably expeditious manner, the first pole hole being dug on July 6th, and the installation completed in every respect before the end of the month.

Most of the equipment including the constant current transformers, panels, G. & W. combination potheads, cast iron standards and lighting fixtures were supplied by the firm of A. H. Winter Joyner, Limited.



Fig. 3—Stratford's Main Street.



# A Year's Developments in Illumination

## Comprehensive Review of the Phenomenal Progress of the Past Twelve Months Towards the Scientific and Economical Production of Good Light

The Illuminating Engineering Society of the United States each year appoints a committee on progress, one of whose duties it is to prepare for the annual convention a report of the developments in the various phases of illumination during the past twelve months. At the recent Cleveland convention a report of unusual interest was presented, extracts of which we are reproducing below. In introducing this report, the committee state that developments in the science of illumination and in the lighting industry have continued to an extent which proves that there has been no lessening of public interest and no cessation in the demand for improved lighting conditions. The "Safety First" slogan is reflected in the fulfilment of the requirements for safety lamps in mines. The detrimental effects of glare have been recognized and an effort has been made to avoid them in the headlights of automobiles. The very considerable increase in the intensities available in both gas and electric sources has made possible to a much greater extent than ever the use of diffusing globes and shades and stimulated the demand for artistic fixtures. The recognition of the scientific side of illumination has been growing and there seems to be more and more of a tendency on the part of those who control the lighting of buildings, stores, etc., both owners and architects, to take into account the principles which have been so faithfully promulgated by this society.

### ELECTRIC INCANDESCENT LAMPS

**Non-Vacuum High Efficiency Tungsten Lamps.**—Last year's report contains a brief statement heralding the advent of the high efficiency tungsten lamp, and its introduction in a wide variety of sizes constitutes the most marked development in the sphere of the electric incandescent light. The use of the spirally wound filament in an atmosphere of neutral gas has made possible a higher temperature and a consequent considerable increase in light intensity, while at the same time bringing the source itself into such a relatively small space as to enhance its value when used in searchlights, in projection lanterns or with focussing reflectors.

At the time of the 1914 report of the Lamp Committee of the National Electric Light Association these lamps were available in the following sizes: for multiple burning on 100-130-volt-circuits 400, 500, 750 and 1,000 watts or in candle-power 535, 715, 1,250, 1,820; for series burning the number of units was larger ranging by moderate steps from 60 to 1,000 candle-power with a voltage range from approximately 6 to 55 and in amperes of 5.5, 6.6, 7.5 and 20. In England for the 100-130-volt range, lamps were announced of 400, 600, 1,000, 1,500, 2,000 and 3,000 mean hemispherical candle-power. At the same time announcement was made of series burning 50-65-volt lamps in 200, 400, 600 and 1,000 candle-power sizes, and of multiple burning on 200-260-volt circuits in 1,000, 1,500, 2,000 and 3,000 candle-power sizes. Subsequently this listing has been extended considerably. In this connection it should be noted that the changes in schedules of these new lamps have followed each other with such rapidity that before this report is published there will doubtless be available new limits of voltage and efficiency and new ranges of candle-power and watts.

In Germany the 50-volt, 110-volt and 220-volt types were advertised late in the fall. These lamps were tipless and contained nitrogen at an absolute pressure of about nine pounds per square inch (0.53 kg. per sq. cm.).

The new high efficiency lamp is being used in German theatres, and in this country in many places requiring very intense sources, such as display lighting and for the lighting of large areas. It is already a strong competitor of the ordinary arc lamps and the high power gas arcs. Efforts are being made to develop this lamp for use in moving picture machines where steadiness and high intensity are important.

Investigations of the properties of this new lamp have indicated a reduction factor in the neighborhood of 0.850, a temperature of approximately 2,600 deg. C. and a ratio of radiated energy to energy input of 60 per cent. as compared to 88 per cent. for the ordinary vacuum type tungsten lamp. A study of the energy distribution showed the wave length of maximum energy to lie close to  $1.1 \mu$  ( $\mu = 0.001 \text{ mm.}$ ) and the ratio of luminous to total energy radiated to be approximately 8 per cent. as compared to 4 per cent. for the ordinary vacuum lamp. The ratio of energy radiated in the visible part of the spectrum to the energy input was found to be approximately 5 per cent. as compared with 3.5 per cent.

**Vacuum Tungsten Lamps.**—Since the first of the year there has been a 10 per cent. increase in efficiency in the ordinary drawn-wire tungsten lamp both in the multiple type and also in the street railway and train lighting lamps and this has been accompanied by a decrease in price of from 10 per cent. to 15 per cent. There seems to be a steadily increasing tendency on the part of central stations to further the use of the tungsten lamp through free renewals and decreases in prices.

According to the Lamp Committee report the quality of vacuum tungsten lamps has been greatly improved. The filaments have been made stronger; a change has been made from heavy to light semi-flexible or flexible supports; and the introduction of chemicals to prevent blackening has been extended to the lower wattage and been greatly improved in the higher wattage sizes.

A decided improvement in these lamps has been along the lines of standardization and uniformity of the various constituent parts such as bulbs, stems, supports, etc.

Among foreign manufacturers a number of filament mountings have been worked out. One giving a maximum intensity in the lower hemisphere consists of a rectangular glass frame from which the supporting wires hang down, the filament being wound back and forth so as to lie in the same horizontal plane, the lamp being used pendant.

The ability to wind the drawn wire tungsten into spirals of very small diameter has made possible also a variety of methods of mounting. An arrangement giving a result similar to the one just mentioned consists in placing the supporting wires radially in the same horizontal plane and looping the filament between them. Another type uses three vertical glass rod supports with the filament wound spirally around them. Another has the supporting wires in the same plane and forming a four pointed star. In another lamp the filament is wound in the form of an inverted cone, and the bulb is either clear or has its upper half frosted and the lower half ribbed. One type uses the grid form first mentioned with the spirally wound filament. In still another type in order to get a maximum of length in a minimum of space vertically and thereby permit the use of a small diameter bulb, the spiral wound wire is held by supports which carry it spirally around the central glass supports.

This year has seen the almost complete elimination of



the tantalum lamp, the number used being less than 0.1 per cent. of the total number of lamps sold, while the number of carbon lamps used has dropped to only 10 per cent.

The government has revised its standard specifications for incandescent lamps. The new schedule calls for 200-260-volt tungsten lamps, raises efficiency limits and lowers voltage limits. The tantalum schedule has been dropped. In both the tungsten and graphitized carbon schedules the sizes of bulbs are named, indicating progress in standardizing which permits such designations.

An extension of that method of rating lamps for efficiency, based on the fact that equal efficiency means equal brightness in vacuum incandescent lamps having the same filament material, has been devised. The method is particularly designed for conditions where the testing voltages are fluctuating, and uses either direct or alternating current. The optical pyrometer principle is involved and the apparatus is very simple, including a voltmeter and some suitably chosen resistances.

The advent of the high efficiency non-vacuum lamp of high current has necessitated the development of special holders which shall provide ventilation and protection from moisture. In the case of the low-voltage high-current type a compensator for street series lamps has been produced which in some cases effects an appreciable saving in energy.

Various devices have been invented to prevent the unauthorized removal or theft of lamps and reflectors. One of these recently developed is so arranged that a lamp once screwed in cannot be removed without breaking it. Replacement of a lamp is accomplished by breaking the bulb, which allows the slipping off of the outer shell of the socket, and permits the unscrewing of the discarded base.

Difficulties in the manufacturing of carbon lamps in the early days are partly responsible for the wide range of voltages in the distributing systems of central stations. But the recent great improvement in the manufacturing processes connected with tungsten lamps has enabled the factory to produce lamps of a given desired voltage to within very narrow limits. It has been suggested that if it were feasible to have central stations adopt a standard voltage, it might be possible to still further reduce the price of lamps by relieving the manufacturer of the necessity of providing for more than one voltage.

Efforts are being made at the present time to have central stations bring their voltage as nearly as possible to the 120-volt centre.

#### ARC LAMPS

The result of considerable research has brought out an improved electrode for the magnetite arc. This, together with a prismatic refractor which redirects light formerly lost, has made a big advance in the mean hemispherical efficiency of this type of arc lamp.

Improvements have been made also in the flaming carbon arc lights. A new type has been developed in which the lamp forms the top of a pillar and which combines the operating characteristics of the long burning arc with the ornamental design inherent in the adoption of the classic column. Research has shown that good operating results may be secured by the use of a small condenser having vertical, concentric sides.

In response to the demand for ornamental units, the appearance and diffusion of arc lamp globes have received some attention with beneficial results.

In enclosed flaming arc lamps the effects of water in the enclosing globes has been studied recently. It was found that one effect is to lower the temperature of the arc due to the formation of hydrogen which rapidly conducts heat away from the electrodes. It was found also that there is a re-

markable shortening in the life of the trim if moisture is present in the globe.

#### VAPOR AND VACUUM TUBE LAMPS

Mercury-vapor lamps in general, function on direct current. Those designed for and used on alternating current are arranged so that the final result is an unidirectional action. A new type of quartz mercury arc has been devised having only two electrodes, between which the current alternates. This is made possible at ordinary frequencies (50 volts) by using voltages not less than 600; a pressure not less than of the order of 1 cm. of mercury; the presence of self-induction in the circuit; and when starting having the electrodes already hot. A lamp of this type has been designed for 1,000 volts at the terminals, 1,000 watts consumption, a power factor of 0.7 and a candle-power of approximately 5,000 giving a candles per watt factor of 5.

Another new arrangement of the quartz mercury arc has for its object the production of a light source comparable in intensity with the carbon arc but with the objectionable heating removed. This is accomplished by making the lamp in the form of an inverted U and placing it in a flask one of whose walls is in the form of a paraboloid which may be silvered, and thus concentrate the light emitted through the opposite wall. The flask is made of pure transparent quartz and uses electrodes of invar metal. The whole is then immersed in a vessel either of glass or with glass sides, filled with water. One of the sides may be made in the form of a condensing lens. A lamp so constructed used 18 amperes with 70 volts at the terminals and was claimed to give 3,000 candle-power or about 0.42 w.p.c. Such a source would have its principal application in cinematography or photomicrography.

In cases where the tilting method of starting mercury-vapor lamps is not feasible, a new starting arrangement has been devised, which uses a small auxiliary vessel containing a reentrant portion in which a heating coil may be placed without disturbing the vacuum. This small vessel is placed immediately below a part of the tube which is near the negative electrode and constricted. Initially the positive and negative electrodes are connected by a thread of mercury which is broken by a bubble of vapor arising and being caught in the restricted portion when the heating coil is started. The operation may be made quite automatic.

**Neon.**—Work is still being done on the study of the properties of the neon lamp. It has been found that, the current being kept constant, the drop in potential along the tube is approximately inversely proportional to the diameter, the tube operating under a pressure of about 2 mm. of mercury and a current density of 6 amperes per square decimeter. The effect upon the luminous power of varying the diameter has also been studied and it has been found that the luminous power increases approximately as the first power of the diameter. Owing to the loss of power at the electrodes, however, tubes of a diameter about 1 to 3 cm. are best if efficiency is to be considered.

In England the neon tube has been put on the market for advertising purposes in a standard length of 6 m. a diameter of 50 mm., and using 1 ampere with 1,000 volts at the electrodes.

**Cathode Lamp.**—A new vacuum lamp has made its appearance based on the fact that the cathode in a vacuum tube becomes very hot on the passing of a discharge. The inventor utilizes this phenomenon to bring to a glow a piece of Nernst heater used as a cathode and contained in a quartz tube, sealed by means of magnesia and pipe clay into a spherical glass bulb.

The claim is made that with 820 volts and 0.11 ampere, or 90 watts, the lamp burns as brightly as a 50 candle-power lamp. Further study is to be made on this lamp.

**Ultra-violet Sources.**—For some time quartz mercury-



vapor lamps, heavily loaded, have furnished the only intense source of ultra-violet radiation in practice. A method has been recently devised which considerably increases the effectiveness of such lamps by using a magnetic field and water cooling. This has the effect of reducing the density and consequent absorption of the vapor envelope, and shifts to the side of the tube the concentrated beam of light which ordinarily occupies the centre of the tube.

Deduced from photographic action the improved lamp shows the greatest intensity in the region  $\lambda = 0.254 \mu$ . A further interesting result is that using this lamp to excite a "resonance" mercury-vapor lamp (a quartz glass absorption vessel provided with a drop of mercury, exhausted and sealed) the extremely monochromatic radiation of wavelength  $\lambda = 0.2536 \mu$  may be produced continuously and with considerable intensity.

A study of the oscillating spark between various metal electrodes as a source of ultra-violet radiation has shown a maximum intensity when using invar, the value being almost twice that obtained with copper.

#### LIGHT SOURCES FOR PROJECTING PURPOSES

**Headlights**—The enormous increase in the use of automobiles both for pleasure and traffic has made the question of proper headlights of steadily increasing importance. In the larger cities particularly legislation to prevent the use of dazzling headlights has been put into effect. One result has been the development of numerous schemes to shut off the excess of light while in the city, but leave the full intensity available for use on unlighted roads.

Instead of using four headlights, two of high power for country touring and two of low power for city driving, one arrangement provides twelve lights placed along the filler board between the wind-shield and the top of the engine hood. When not in use the lamps are completely covered by a sliding shutter which may be moved to permit the use of as many as desired and of particular ones if necessary. Furthermore the angle of the group of lamps can be varied at the will of the driver, so as to illuminate any portion of the road, or the engine of the machine.

In another system, two lamps are used, having a tubular body, fitted with a system of lenses and a reflecting mirror, the result being a concentrated beam projected in nearly parallel rays, and capable of easy direction.

Another form has two pairs of translucent wings mounted on pivots and made to open and close by electromagnets controlled by a push button on the dash.

The National Physical Laboratory has had the subject under advisement for some time and recommends the cutting off of the light beams coming from the upper right hand corners. The right hand corner is indicated because in England the rule of the road is to the left.

In regard to locomotive headlights a similar state of interest is evident, but the crying need for definite information as to the actual needs in this direction is evidenced by the fact that in this country twenty-eight states have adopted legislation embodying seventeen different specific laws governing the use of such headlights.

**Searchlights**.—A big advance in searchlight construction is shown in a new type which has small electrodes, operates at a high current density and temperature and has an improved specific consumption. The current density is about six times that of earlier types of lamps. This is accomplished by forcing alcohol vapor around the electrodes to act as a cooling medium and protect the electrodes from too rapid combustion.

The positive crater appears like a sharply defined point of light of extremely high specific intensity. The feeding of the alcohol vapor takes place automatically when the arc is

struck, a valve governed electromagnetically being used for this purpose. Both electrodes are rotated uniformly in order to maintain perfectly uniform bathing of gas, and are placed the one horizontal, the other at a certain angle to insure equal combustion.

**Signal Lights**.—A striking departure from former methods of railway signalling is forecasted in the results of tests made to determine the right intensity of a signal lamp so that it will be clearly visible in bright sunlight and not too dazzling at night. If practical experience proves the system to be as effective as the preliminary tests indicate, the old semaphore arm method of daylight signalling will become obsolete in cases such as electric roads where energy is cheap.

The method of momentarily obtaining high intensity by using a tungsten lamp at voltages much above normal has been utilized in a signalling device for soldiers and airmen. It consists merely of a minute incandescent lamp in conjunction with a parabolic mirror and arranged so that the circuit can be closed intermittently to give long or short flashes, corresponding to the dots and dashes of the Morse code.

Another advance in the use of lamps for signalling is in connection with city traffic. A scheme is being tried out in Cleveland of directing traffic at busy street intersections by red and green lamps placed on cross arms on 15-ft. (4.57 m.) poles at each of the four corners. Control is vested in the traffic policeman who is in a booth at one of the corners.

An improvement on the reflecting portion of the light source of light-houses uses a mirror composed of elements both parabolic and annular combined with a spherical mirror. The former project the rays emitted from the front of the lamp, and the latter those from the rear.

#### MINER'S LAMPS

The past year has seen a remarkable development in safety lamps for use in mines. Over a year ago in a competition held in England 195 different portable lamps were submitted and of these a number were accepted. Recently the British Home Office has approved of several new types.

As the result of a prize competition in Germany, a lamp has been evolved which is not only safe if broken but is also claimed to give indication of the presence of fire-damp. The principle on which the indicator is constructed is based upon the law of diffusive action. The indicator consists of a U tube containing a colored signalling fluid and so disposed that the presence of gas causes an obscuration of the light.

However, objections have been raised to this form of indicator based on the fact that it would not be operated upon by an explosive gas mixture, if this mixture were of the same density as the air.

In this country developments have proceeded along two lines, lamps designed for mines where fire-damp or other explosive gases are encountered, and those designed for mines such as metal ore mines where these difficulties are not encountered. Three out of six lamps sent to the Bureau of Mines for test were accepted for use in gaseous localities. These were of both the hand and cap service type. The following specifications have been issued by the Bureau:

Intensity of light at all times . . . . .	0.4 cp.
Flux of light at all times	
Hand lamps . . . . .	3 lumens
Cap lamps . . . . .	1.5 lumens
Time of burning per charge . . . . .	12 hours
Average life of bulb . . . . .	300 hours
(Not more than 5 per cent. to have less than 250 hours.)	
Average life of batteries . . . . .	3,600 hours
Variation in energy consumption of bulbs . . .	10 per cent.
Angle of reflector . . . . .	100 degrees



## STREET LIGHTING

The constant demand for better public lighting is reflected in the increase in installations in some of the large cities of the country, during the past year. The luminous arc was being installed in large numbers up to the time of the introduction of the non-vacuum high efficiency tungsten lamp. There is already considerable evidence that the latter will be used in many places to replace the former.

## EXTERIOR ILLUMINATION

The satisfactory results obtained in the artificial lighting of tennis courts has caused a considerable extension of this form of lighting. In England, covered tennis and squash courts have been artificially lighted, both with high pressure gas units and electric lamps.

The value of light seems to be more and more appreciated in every walk of life. An experiment in the use of artificial light to increase the output of a poultry farm has resulted in a reported increase of 30 to 40 per cent. in the number of eggs laid. In the case of young incubated chicks, the use of light made them feed longer and thereby accelerated their growth during the winter months by a third.

The growth of *aeronautics* has created the need of properly illuminated fields for rising and descending at night, and various suggestions have been made and experiments tried to determine the most suitable method. A need has also arisen for illuminated signals and signs so that an aeronaut travelling at night may determine his location and avoid dangers in descending. In the case of signal lights on the machine themselves, it is evident that arrangements must be made to indicate not only the direction of travel in a single plane but also whether a rise or drop is contemplated.

It is interesting to note that the Port of London Authority has recently equipped the dock policemen with electric torches to take the place of the old fashioned oil lanterns.

The logical development of the animated sign has made its appearance in the use of moving vehicles carrying highly illuminated displays.

The lighting of Christmas trees in the home is a custom almost if not quite as old as the use of the tree itself. A recent innovation adopted by many American cities at the last holiday season consisted of out-door "community" trees, in all of which illumination was a conspicuous feature of the ornamentation.

In regard to display lighting in general there has been a decided increase in the number of buildings lighted on the exterior for display purposes. In the past there have been numerous cases of so-called "outline" lighting, in which the lights showed the contours. A new method called "flood" lighting is being introduced in which the exterior of the building is brilliantly illuminated by sources placed at a distance.

The use of high towers for street illumination purposes was discontinued some years ago. The system has been revived recently for use in lighting railroad yards. Steel towers 100 ft. high and 12 ft. square at the base have been placed at 500 ft. intervals and equipped with quartz mercury-vapor arc lamps.

## INTERIOR ILLUMINATION

**Car Lighting.**—Interest in improving the lighting of railway coaches and street cars continues and is apparently growing. Indirect and semi-direct methods are being studied. In one city twenty street cars have been equipped with three different semi-indirect systems in order to see which appeals most strongly to the public. There is a general recognition that bare lamps are bad and that it is well worth while to use reflectors.

The final report of the Committee on Illumination of the Association of Railway Electrical Engineers contains among other conclusions that equally satisfactory results may be obtained with either the centre deck or half deck arrangement of the lighting units; best results will be obtained with a spacing not greater than two seats apart. The elaborateness of the tests and the expense involved are a most gratifying tribute to the importance attached to better lighting in trains.

**Store Lighting.**—That the educational efforts of this society are continuing to bear fruit is indicated in the lighting installation of a large department store. In this case the window lighting system was worked out with foot lamps and border lamps equipped with movable color screens, so that the quality of the light could be altered to suit the requirements. The main lighting, of the semi-indirect type, has also a modified color value. For the trying on of theatrical costumes, the foot lamps and border lamps are not only provided with means for color modification, but also with dimmers and a spot light is likewise available.

In order to eliminate the annoying reflections from the glass of show windows, a new system has been devised in which the window pane is made concave inward.

Another novel application of the indirect lighting system has been made in the case of banks where the lamps are contained in troughs along the bank rail over the teller's desks.

**School Lighting.**—During the course of an extended discussion before the British Illuminating Engineering Society on the subject of daylight illumination in schools, it was brought out that as a minimum actual illumination on the desk for reading in the school room in full (midday) daylight, different authorities recommend from approximately 1 to 8 foot-candles. Among the new suggestions were, the determination of the "sill-ratio," i.e., the ratio between the illumination on the window sill of the school room and that on the desk most remote from the window, as a means of determining the access of daylight into schools; experiments to ascertain how far it is possible by using small models to predict the actual daylight conditions in an interior; and an "indicator-photometer" as a means of signaling when the artificial light should be turned on.

In a later interim report the following tentative suggestions were made:

No place is fit for use as a schoolroom when "diamond type" cannot be read easily by a normal observer at a distance of half a meter.

The darkest desk in any schoolroom should receive an illumination equivalent to that derived directly from 50 reduced square degrees of visible sky. In these circumstances the place should receive not less than 0.5 per cent. of the unrestricted illumination from the complete sky hemisphere.

The windows should be located in the wall to the left of the pupils, and the glass should be carried to the ceiling and not interrupted by cornices, pillars, or decorations.

No desk in a schoolroom should be farther from the window wall than twice the height of the top of the glass above the desk surface.

The ceiling should be white. The wall opposite to the window and the wall behind the children should be lightly colored from 30 in. (0.76 m.) above the desk level. The wall around or behind blackboards should be somewhat darker than the rest of the room.

All furniture, desks, and surfaces in the lower part of the room should be finished in an unobtrusive color, dark shades and black being avoided.

It should be noted that there are some points in these suggestions on which more definite information is desirable,



and further work on the subject will doubtless meet this need.

**Church Lighting.**—There is a growing tendency away from the old belief that the interior of a church should be in a state of twilight illumination, toward a realization that the church should be made cheerful and that this is to be accomplished by good lighting. For this purpose the indirect lighting method is growing in favor although the lower installation and operating costs, as well as the architects' influence, are responsible for the use of direct lighting in some cases even in new churches.

**Picture Lighting.**—The proper lighting of pictures has been a vexing problem with illuminating engineers for many years. While it is comparatively easy to see what is required for a single picture, to produce the result not only for one, but many has taxed the resources of numerous engineers and architects. At a recent Art Loan Exhibition an effort was made to illuminate the pictures as far as possible by light coming from the right direction and also of the proper color content. Plain and colored lamps were used, placed in troughs above and in front of the frames and so arranged that no light was specularly reflected to the eye of the observer.

### GLOBES, REFLECTORS AND FIXTURES

Since the last report there has been a great increase in the variety of reflecting and diffusing equipment available for lighting. This increase has proceeded along artistic lines, along engineering lines, along the lines of special adaptation to particular needs, along the lines of higher and lower priced units and of larger and smaller units.

This increase in variety is particularly noticeable in the semi-indirect field. In selecting units to-day, the selection can be made from a much greater choice than was possible a year ago. There is also a tendency on the part of manufacturers to put out units which approach direct lighting in the results they give, as far as diffusion is concerned, but have the appearance of a semi-indirect lighting unit. This has resulted in the closing of the gap between direct lighting and semi-indirect lighting, as far as reflecting and diffusing equipment is concerned. This emphasizes the need of some other terms than indirect and semi-indirect to apply to lighting systems.

There is a greater tendency in the design of globes and reflectors to have them particularly adapted to architectural needs and particular classes of service. There is a greater variety of units corresponding to particular periods of architecture, and units designed especially for the lighting of churches, hospitals and residences are more in evidence.

From an engineering standpoint the most marked developments during the past year are those involving the use of semi-indirect fixtures for both gas and electric lights and in particular those which have accompanied the advent of the high candle-power and high efficiency gas cluster lamps and the non-vacuum tungsten lamps. The high intensity of these types has made the need for the use of diffusing globes more apparent than ever. In all the units put out for these lamps and the holding equipment for them, the ventilation is an important feature and in the case of gas lamps mica sheets are utilized to baffle the heated products horizontally and thereby prevent ceiling discoloration. Mica baffles are also used in gas lamps below the source to prevent over heating of the glassware. Another point of interest in the tungsten lamp is that the type of filament is much more concentrated than formerly and this is a distinct advantage in that it is possible to obtain higher efficiencies and better distributions of light than were formerly possible with much longer filaments.

In industrial lighting there has been a noticeable tendency

in the direction of the increased use of deep bowl reflectors. In street lighting a prismatic refractor has been developed which gives a very extreme distribution of light, the candle-power being highest at about 75 to 80 deg. from the vertically downward direction.

The extent to which the artistic in lamp fixtures has progressed is shown in the production of a dome made of china by a manufacturer of artware and dinner sets.

Mention was made in last year's report of the use of marble in thin sheets to replace glass in lamp fixtures. A big improvement in this material is shown in the production of plates  $\frac{1}{8}$  in. to  $\frac{4}{5}$  in. thick (3 to 20 mm.) polished on both surfaces and impregnated with various oils at high pressure and temperatures. In this connection a recent investigation of this material has shown that it is much more translucent than milk glass. The treated marble was found to transmit more red and much more blue than milk glass and is a good diffusing agent even though having a translucency of 40 per cent. The following table shows the results found on the translucency and diathermacy of these marble sheets as compared with various substances.

Translucency and Diathermacy of Various Substances

Thickness and material of interposed stratum	Percentage of light transmitted	Percentage of heat transmitted
None ... ..	100	100
Treated marble 0.12 in. (3 mm.) ...	41	5.1
Untreated marble 0.12 in. ... ..	21	4.9
Mica 0.02 in. ... ..	33	67.5
Clear glass 0.08 in. (2.2 mm.) ...	92	80.0
Hard rubber 0.01 in (0.3 m.) ...		51.7
Writing paper ... ..	27.5	4.8
Writing paper oiled ... ..	55	16.7
Milk glass 0.12 in. ... ..	25	16.6
Ground glass 0.12 in. ... ..	76	40.6

A still further extension of the daylight duplication idea is to be found in the development of spectacles made of colored absorbing glass fitted with a dyed film. Different spectacles are designed for different light sources, the materials used being the same as those which would be required in order to make an artificial daylight lamp out of the source in question.

Fixtures have also been designed which give a light distribution in a room similar to that given by a window, thus imitating daylight distribution.

The importance of avoiding glare is being appreciated to such an extent that spectacles using colored glass have been devised for attachment to the visor of a base ball player's cap. They are instantaneously adjustable and should be of considerable help to the player when it is found necessary to look directly toward the sun.

### Trade Enquiries

Name and address of inquirer may be obtained on application to the Electrical News, Toronto.

**920. Electrical machinery, all kinds.**—A South African firm of electrical engineers makes inquiry for catalogues with f.o.b. prices on Canadian-made electrical machinery of all kinds.

The Gananoque Electric Light & Water Supply Company, Limited, have submitted to the corporation of the city of Kingston a proposition for the supply of approximately 700 h.p. of electrical energy at the rate of  $\frac{3}{4}$ ¢ per kw.h. The proposition deals with other matters also, such as obtaining from the corporation the right of way over certain streets, etc. The entire matter has been submitted to the city solicitor and Mr. C. C. Folger, general manager of the light, heat, power and water department.



# Typical Residence Lighting Specifications

## A Detailed Scheme for the Illumination of the Average Sized Home

By Mr. S. G. Hibben, Illuminating Engineer

In the Electrical News of September 1st was given a typical set of wiring plans and specifications covering the electrical equipment of a residence of average size, including all necessary details from the main switch and fuse box up to and including the point of providing the lighting fixture outlets, switches, outlets for portable cooking, heating or lighting accessories, as well as a discussion of the factors governing the choice and location of such outlets.

We here present a similar outline, beginning with the

glare, the right amount of light, the most harmonious and decorative units, moderate expense and permanency.

The same set of plans is used in this connection as were previously printed as forming a part of the wiring specifications.

### General Specifications

The following general specifications, in conjunction with the tabulated details and plans that accompany and form a

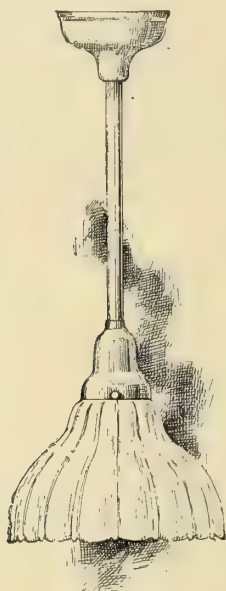


Fig. 1.

outlets as previously located, and detailing the types of lighting fixtures, with lamps and glassware, that would be necessary in securing the complete lighting installation.

As stated in connection with the wiring plans, it is hardly to be expected that these suggestions will coincide with the individual tastes or requirements of every house builder. They are intended to illustrate the method of procedure and to show how advantageous it is to have a comprehensive out-

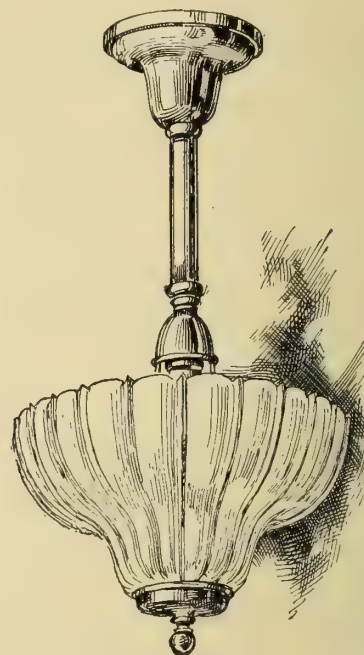


Fig. 3.

part of this report (see page 54) cover the location of lighting fixtures, the style and finish of same, the glassware equipment, the hanging heights, the proper lamp sizes, and the general results secured.

### Outlets

The outlets are used as shown on the accompanying

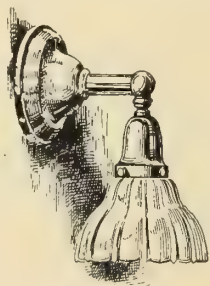


Fig. 2.

line of the lighting fixture equipment in an accessible form. The choice of the lighting fixtures has herein been based on engineering considerations, keeping always in mind the artistic side of the question as well. Without lengthy and tiresome discussion it would be impossible to give all the reasons for the selection of various fixtures. These selections are based on items of efficient control of light, avoidance of

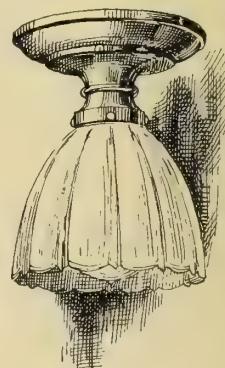
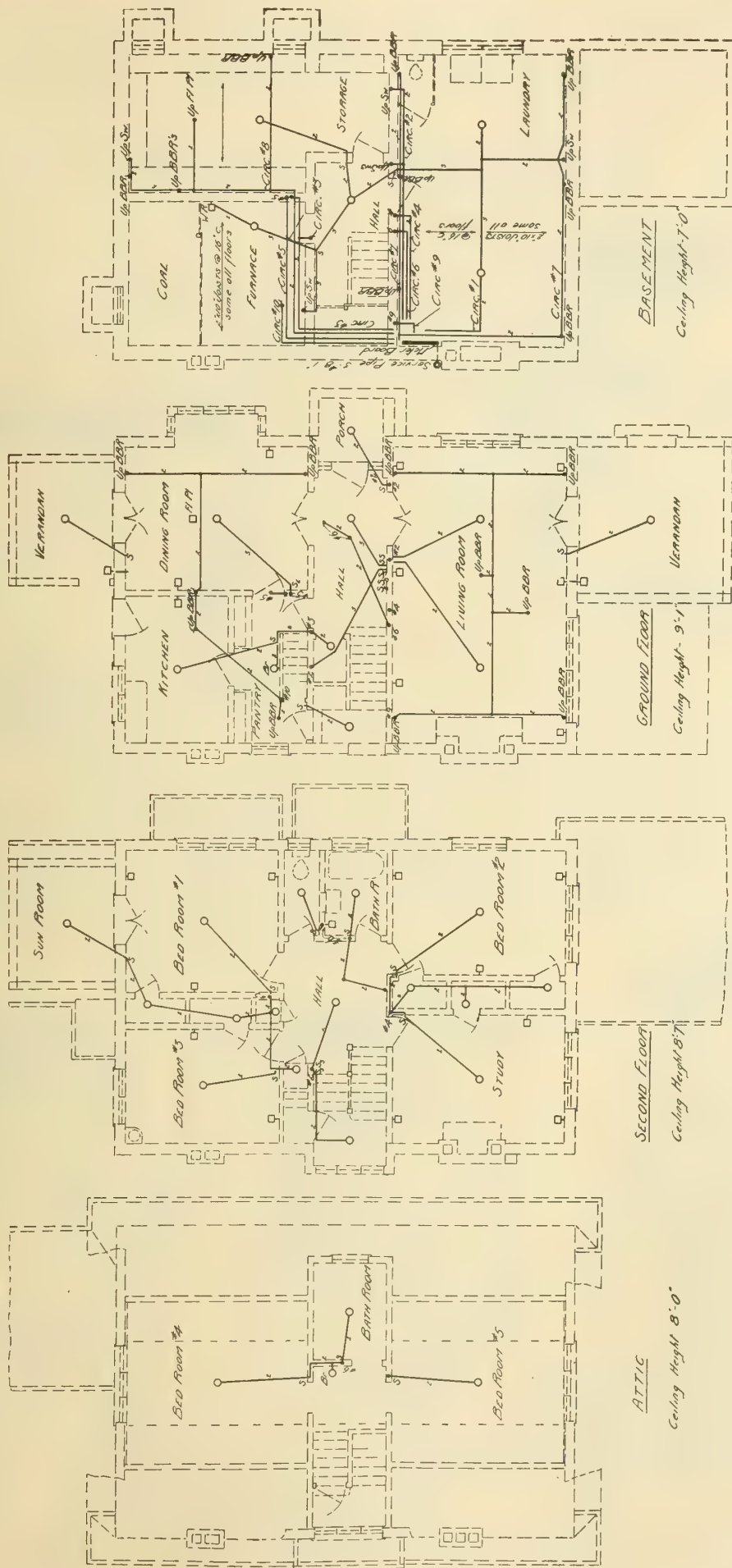


Fig. 4.

plans, such positions being in general satisfactory for the correct distribution of light. Any radical changes in outlets, caused by changes in the wiring on account of furniture, etc., should be given additional consideration inasmuch as the





Model diagram, for illumination purposes, of a typical residence of average dimensions—Also see specifications, p. 54.



specified fixtures are selected for exact individual service only in the places where specified.

No details are herein given for portable electric apparatus such as table lamps, electric irons, radiator stoves, etc., for which baseboard, floor or wall outlets have been provided.

### Fixtures

All fixtures are to be provided wired complete ready to hang, but without lamps.

Finishes of metal parts are to be as specified in the de-

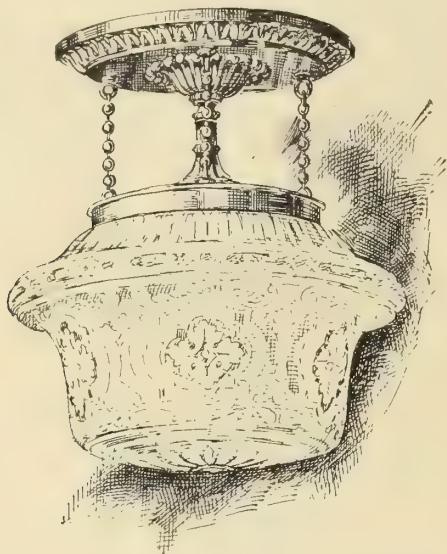


Fig. 5.

tailed scheme, such finishes to harmonize with the other interior hardware.

Metal parts of all fixtures to be of standard and approved gauge if spun, or of clean chaste detail if cast. No stampings are to be used.

All proper glassware holders are to be furnished as a part of fixtures. No changes in glassware or in lamp sizes are to be made without corresponding changes in holders.

Fixtures designated as "receptacles" to consist of porcelain base receptacles of approved make. All such recep-

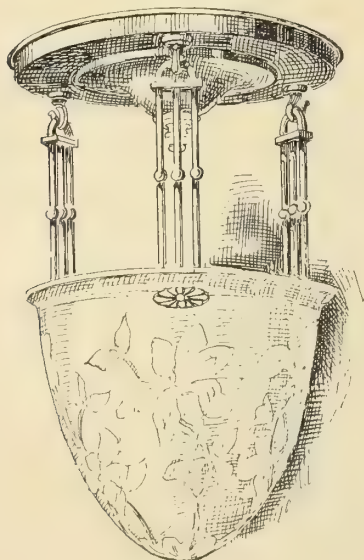


Fig. 6.

tacles in closets are to be provided with pull-chain control. All such receptacles for items 22 and 23 to be provided with Form "O"-2¼-in. holders. No holders are to be furnished for other receptacles.

### Lamps

No lamps are to be provided on this schedule. However, the sizes as specified should be carefully adhered to

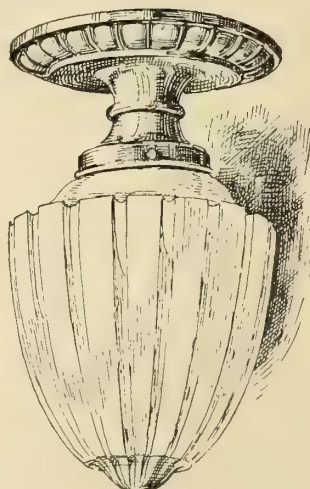


Fig. 8.

in purchasing, in order to insure the correct relation between the lamps and their reflectors or globes. Lamps should be clear, bowl (or end) frosted, or full-frosted as specified, and should be chosen to burn at their top voltage as marked on the lamp label.

### Glassware

All glassware is to be used as detailed, since any changes will jeopardize the efficiency and harmony of the system.

Illustrations of all recommended glassware appear together with the illustrations of fixtures that accompany and form a part of this report.

### Illumination Results

In general the illumination will be found satisfactory for all ordinary conditions. The results will depend considerably upon the colors of interior finishes. In the bed rooms, baths,

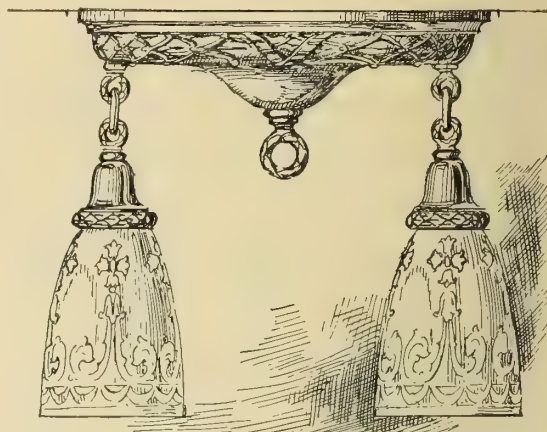


Fig. 7.

sun room, halls and closets the interiors should be light, as gray, cream, light tan, light pink, etc. In dining and living rooms and study the finishes may be slightly darker, as shades of green or gold, old ivory, etc.

Under the above conditions the illumination over the useful portions of the several rooms (at table height) will be about as follows:—

Bed Room No. 1 . . . . . 2.5 Foot-candles

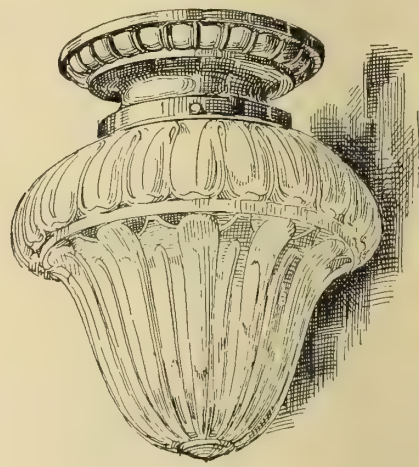


Fig. 9.

Hall . . . . .	2.0	"	"
Kitchen . . . . .	4.0	"	"
Living Room . . . . .	2.5	"	"
Dining Room . . . . .	6.0	"	"
Veranda . . . . .	0.7	"	"

In commenting upon the detailed specifications, the following points might be mentioned:



**Attic**

1. The pendent fixture in the bath room is especially suitable, on account of its simplicity and its sanitary features. A 60 watt lamp may replace the 40 watt lamp here if considerable use will be made of this room. The distribution of light is fairly extensive.

2. Bed rooms 4 and 5 will be evenly and softly illuminated by the simple semi-indirect units, making brackets unnecessary for local lighting. The chosen type of fixture is inexpensive, yet efficient.

**Second Floor**

1. In the toilet the most simple type of ceiling fixture is satisfactory in holding an intensive form of reflector, to direct most light downward over a small area.

2. The fixture for bedroom No. 1 will be particularly decorative in a room finished in rose, cream or blue colors. It employs a softly diffusing globe, etched and decorated in mauve and lavender or gray and blue tints.

The 100 watt rather than the 60 watt sizes of lamps are used here and in bed room No. 2, since no wall brackets are to be used.

3. Bed room No. 2 has a fixture with diffusing bowl having a little warmth in colors of green and pink. The lamp in this bowl should not be placed too low, in order to secure the best results from ceiling reflection.

4. The study being most probably furnished on the order of a den, would be properly equipped with the verde antique fixture No. 19832, and amber tinted glassware giving most emphasis in illumination directly beneath the fixture. A portable lamp will be used here for reading.

**First Floor**

1. Efficiency is the keynote of the lighting fixture in the kitchen. Considerable illumination is provided for here. Glassware is used that may be easily cleaned.

2. When using the semi-indirect unit over the dining room table, it will be found to brightly illuminate the table top, and the rest of the room less so. Three lamps in the bowl are to be arranged on one circuit, and one lamp on the other, thus allowing dim, medium or bright lighting.

3. The living room fixtures are primarily to be for de-

coration as well as utility, since a portable table reading lamp will no doubt be used.

**Basement**

1. Efficiency and economy are considered above all else

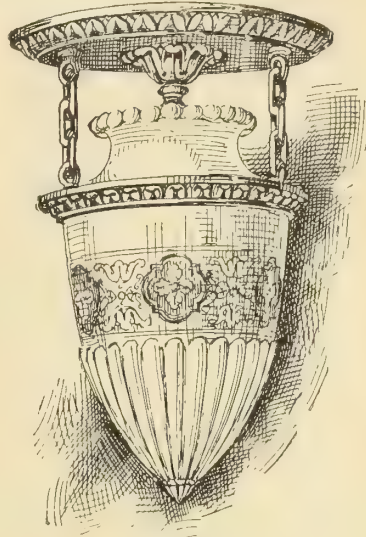


Fig. 13.



Fig. 14.

in the lighting of the basement rooms. Reflectors in the laundry are more broadly extensive than in other rooms.

**Illuminating Engineering Society**

The General Convention Committee of the Illuminating Engineering Society have published, in advance of the Convention, very interesting and complete details of the proceedings and have distributed widely an attractive souvenir programme. An interesting feature of this programme is a brief synopsis of each paper which gives, in a few lines, the scope of the matter to be covered in each case. The booklet also contains the entertainment programme of the entire week, together with considerable other information about the convention.



Fig. 10.

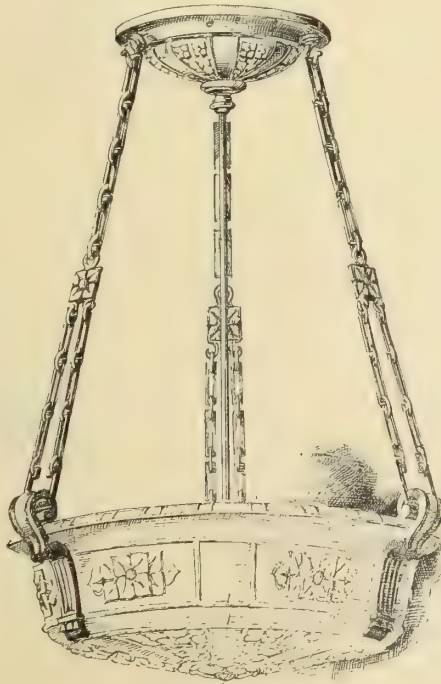


Fig. 11.

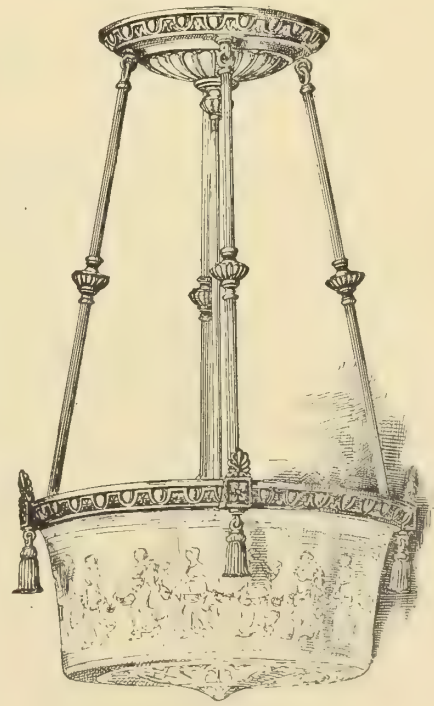


Fig. 12



## Detailed Specifications for Model House

Item	Space to be illuminated	No. of outlets	General type of fixture	Fix- ture No.	Finish	Fix- ture height	Class and type of glassware	Size of lamps (Tungstens except where noted)	Illus. No.
<b>ATTIC</b>									
1	Bath	1	1-E Pendant	40912	W E	1' 6"	Alba Shade 3424	40 W Bowl Frost	Fig. 1
2	Hall	1	1-E Bracket	70012	B B	5' 3"	Alba Shade 3419	25 W Bowl Frost	Fig. 2
3	Bed Rooms 4 & 5	2	1-E Semi-Ind.	50100	B B	1' 8"	Alba Shade 3446	100 W Clear	Fig. 3
<b>SECOND FLOOR</b>									
4	Bath	1	1-E Pendant	40912	W E	1' 9"	Alba Shade 3424	60 W Bowl Frost	Fig. 1
5	Toilet	1	1-E Ceil. Fixt.	31002	B B	On Ceil.	Alba Shade 3417	25 W Bowl Frost	Fig. 4
6	Bed Room No. 1	1	1-E Fixture	48717	B B B	1' 4"	Decora Globe 3660	100 W Clear	Fig. 5
7	Bed Room No. 2	1	1-E Fixture	55980	B B	1' 6"	Decora Bowl 1605	100 W Clear	Fig. 6
8	Bed Room No. 3	1	2-E Fixture	23722	B B	1' 6"	Decora Shade 1601	40 W Clear	Fig. 7
9	Study	1	3-E Fixture	19832	V	1' 6"	Iridile Shade 2649	40 W Clear	
10	Sun Room	1	1-E Ceil. Fixt.	33004	V	On Ceil.	Alba Globe 3773	60 W Clear	Fig. 8
11	Hall	1	1-E Ceil. Fixt.	33016	B B	On Ceil.	Alba Globe 3658	60 W Clear	Fig. 9
12	Stair Landing	1	1-E Ceil. Fixt.	33004	B B	On Ceil.	Alba Globe 3656	25 W Clear	
13	All Closets	7	1-E Recept.	.....	.....	On Ceil.	No Glassware	25 W Full Frost	
<b>FIRST FLOOR</b>									
14	Kitchen	1	1-E Cord Drop	41000	.....	1' 6"	Alba Shade 3429	100 W Bowl Frost	Fig. 10
15	Dining Room	1	4-E Semi-Ind.	51399	S B	2' 2"	Alba Bowl 3649	3-40 W Clear	Fig. 11
16	Living Room	2	1-E Semi-Ind.	55318	B B B	2' 4"	Decora Bowl 3746	1-25 W Clear	Fig. 12
17	Hall	1	1-E Fixture	48707	B B B	1' 4"	Alba Urn 3652	100 W Clear	Fig. 13
18	Pantry	1	1-E Bracket	70012	B B	5' 3"	Alba Shade 3419	60 W Clear	Fig. 2
19	Large Veranda	1	1-E Ceil. Fixt.	31004	V	On Ceil.	Alba Ball 2688	25 W Bowl Frost	Fig. 14
20	Porch & Small	2	1-E Ceil. Fixt.	31003	V	On Ceil.	Alba Ball 2687	40 W Clear	
21	Closets (2)	2	1-E Recepts.	.....	.....	On Ceil.	No Glassware	25 W Full Frost	
<b>BASEMENT</b>									
22	Laundry	2	1-E Ceil. Recept.	.....	.....	On Ceil.	Alba Shade 3432	60 W Bowl Frost	
23	Hall	1	1-E Ceil. Recept.	.....	.....	On Ceil.	Alba Shade 3424	40 W Bowl Frost	
24	Storage	1	1-E Ceil. Recept.	.....	.....	On Ceil.	No Glassware	40 W Clear	
25	Furnace Room	1	1-E Ceil. Recept.	.....	.....	On Ceil.	No Glassware.	60 W Clear	

## Effect of Consumers' Apparatus and Wiring on Distribution

By H. Goodwin

It is a comparatively simple matter to lay out a system of wiring a building, distribution lines and station apparatus which will give perfect service for any given combination of loads, but the duties of a distribution engineer are to make the best use of the lines available for supplying any proposed load without involving such cost as to make the proposition prohibitive from a commercial standpoint or without putting the consumer to such great expense for interior wiring as to make the service undesirable from his point of view.

When public electric service was first started it was for lighting purposes only. The service was generally only half night service; interruptions were frequent and voltage regulation was comparatively poor.

Conditions have changed and continuous good service has become in many cases a necessity.

## Motor Service

The use of current for lighting was soon followed by the use of current for motors. These motors were at first small, and on account of the general irregularity of service no great trouble was caused by them. The power business has since become very important. The multitude of uses for small motors has also contributed very largely to obtaining many consumers for lighting. Since the introduction of electric current for power and lighting have gone hand in hand, it is natural that often a single service has been run for supplying both the light and the power and the consumers' wiring has been simplified as much as possible by the combination of lighting and power loads without regard to interference with service to one by the other.

Since motors cannot be started without a greater demand from the lines than is necessary to run them after starting, various well known devices have been introduced to minimize the starting current.

Many electric power companies employ polyphase generation and both polyphase and single-phase distribution, the latter for lighting and small motors. In such cases it is necessary (in fairness to motor users as a whole and to the

company) to have some fixed rule as to size of motor above which no single-phase service will be rendered and below which no polyphase service will be rendered. This size varies from 1 h.p. to 7.5 h.p. with different companies, depending upon local conditions.

The polyphase motor means a lower initial and a lower maintenance cost for the user; and for the power company it means lower and better balanced starting currents and less interference with lighting service of other customers, but on the other hand polyphase motors mean greater line and transformer expense (except in large sizes) and greater metering expense. Such a rule as to maximum size of single-phase and minimum size of polyphase when once established in a community should be strictly adhered to in order to save money both for the company and for the small polyphase motor user when he moves from one street to another.

In order to cut down the starting current the general practice is to require auto starters on single-phase motors from two h.p. up and on polyphase motors of five h.p. and up.

In the report of the Electrical Bureau of the city of Philadelphia, just issued, the following appears:—

"The time required in repairing troubles on the underground system has been very much reduced by the use of an electric truck, the number of hours in which the underground circuits were out of service having been cut down in 1913 about forty per cent. as compared with 1912.

"The cost of operation in 1913 was a little less than for 1912 even with the greater amount of work.

"The forces employed were twenty as compared with twenty-one in 1912."

At the annual meeting of the Dorchester Electric Company, held at Quebec on September 8, the following were elected directors: Hon. Nemese Garneau, Messrs. C. H. Branchaud, Joseph Gosselin, G. E. Tanguay, G. Proteau, Milton L. Hersey, A. E. Doucet, Ferdinand Roy and H. A. Cook. Messrs. Milton L. Hersey and H. A. Cook replace Messrs. J. Robinson and W. T. Wilson.



# Good Lighting vs Highest Efficiency

## Proper Illumination a Paying Investment—Better Work and More Work—Discussion of the Main Factors to be Considered in Industrial Lighting

Good lighting bears a well-defined relation to the amount and quality of the factory product. If the lighting is poor, the shop is not operating at its highest efficiency. Time is consumed in carrying over the tool or the work or both to a place where the light is good, or time is lost in moving the light, or inferior work is done in a poor light. The demand for better illumination is of course greater during the winter months. Not only is this urgent on account of increased quality and quantity of product, but the number of accidents resulting from improper lighting have been shown to be very considerable. Indeed statistics compiled in a number of industrial plants at different seasons of the year show that, as the number of daylight working hours diminishes, the number of accidents increases in nearly the same proportion. It has also been shown, however, that this increase in the number of accidents can be wiped out under conditions of correct illumination. Under the conditions of our Workman's Compensation Act, the elimination of accidents will be a very prime consideration, and no factory manager will be well-advised who does not see to it that his illumination is of the best.

The cost of a correct lighting system is considerably less than is generally supposed, and is negligible when compared with an operator's wage. In support of this statement we submit the following analysis:—

A 100 watt lamp, lighting 100 sq. ft., is assumed for each man; and that it burns 2 hours a day for 300 days.

Cost of lamp (\$150 contract; 17 per cent. discount) ..	\$0.67
Average cost of bowl shaped enamelled steel reflector ..	.95
Estimated cost of wiring per outlet .. . . . . .	4.00

Total first cost .. . . . . .	\$5.62
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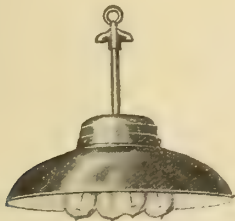
Interest on investment 6 per cent. ....	\$0.34
Depreciation on reflector and wiring 0.12½ per cent. .... . . . . .	.62
	\$0.96

Power at 5c. .... . . . . .	3.00
-----------------------------	------

Cleaning at 3c. per cleaning, two per month ....	.72
--	-----

Renewal of lamp ——— × 0.67 .. . . . . .	.40
600	
1000	

Total .. . . . . .	\$5.08
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Wages for 10 hours a day, 300 days, at 35c per hour are \$1,000.

Ratio of cost of lighting per man, to wages =	5.08
	1000

0.508 per cent.

The above figures show that one-half of one per cent.

of a man's wages is sufficient to provide him with adequate illumination. In other words, with the conditions outlined above, if improved illumination saves the operator three minutes during the day, the light has more than paid for itself. This says nothing of added safety to the operator or improved quality of the workmanship.

In industrial lighting problems there are three main factors which need consideration:

1. The average intensity of illumination required on the working plane.
2. A convenient size and spacing of the lighting units to give a reasonably uniform illumination on the plane.
3. The watts per square foot necessary to give the required intensity of illumination.

These three main factors must be considered individually and collectively, and their solution must depend to a large extent on the past experience of the illuminating engineer.

The average intensity of illumination required on the working plane has been time and again tabulated for almost every variety of building and process of manufacture. These tables, which vary considerably according to the source from which they spring, should act as a guide in making up illumination specifications. Conditions vary so greatly that every case requires individual attention, and no hard and fast rules can be laid down for intensity of illumination required.

The intensity of illumination required depends not only



on the character of the work carried on, but also on the color of the materials worked with; the color of the background those materials are viewed against, and more particularly, the contrast between these two.

A man threading a needle requires good illumination, but while this illumination may be 1,000 ft. candles, and the needle be held against a steel grey background, it will be a difficult matter to thread same. However, if the illumination is reduced to ½ ft. candles, and white background employed, the needle can be threaded with ease. This is an experiment which can be easily tried, and is most convincing. Thus, it would seem that it is possible to imagine different conditions under which 1,000 ft. candles is insufficient, and ½ ft. candle is more than sufficient for comfortable seeing.

Machine parts and commercial materials generally are dark in color, and consequently it is an enormous help to comfortable seeing if all backgrounds, whether walls, ceilings, pillars, and in some cases even parts of floors, be light in color, preferably white or light yellow.

Not only are light walls and ceilings of value in giving contrast, but more important still, they reflect an enormous amount of light which would be otherwise lost, and thus serve as a secondary light source of large area, and low intensity, which produces a minimum strain on the eyes.

In many buildings of the older type of construction,



where the windows are comparatively small, this light reflection is necessary to assist daylight illumination.

To fix any definite illumination intensity, therefore, it is necessary that a thorough knowledge of the buildings be at hand. It is an easy matter, if expense be disregarded, to lay out a lighting scheme which will give more than sufficient light, but what the factory manager wants, and what he asks the illuminating engineer to design, is a lighting scheme which will give everywhere sufficient light and no more; sufficient light being usually defined as that amount which will enable an employee to work quickly and accurately without eye-strain, and further will allow employees to see their way about the shop and around moving machinery without liability to accident. The problem of the illuminating engineer is to make interest on first cost, plus cost of upkeep, plus cost of power, a minimum.

The necessity of getting as much light as possible on the working plane together with the essential necessity of keeping rays from sources of high intrinsic brilliancy from striking the eye, have proved beyond any doubt the economy and advisability of using reflectors with all lamps, and globe



diffusers with many. The shape of these reflectors, and the position of the lamp in them, are chosen with a view to screening the filament of the lamp and reflecting light in such a direction as to increase the uniformity of illumination on the working plane, or to localize it on a particular object. The cost of upkeep will be kept at a minimum by using tungsten lamps with reflectors that are easily cleaned.

Having selected a convenient lamp size, and chosen a suitable reflector, the candle power curve of this unit should be used to obtain the illumination given by it at various points on the working plane. Taking four such units and imagining them placed at the four corners of a rectangle of dimensions equal to the lamp spacing, a curve can be plotted which will show the variation of illumination along the plane between the units.

When such curves have been drawn for a large number of cases an accurate estimate of the average intensity of illumination can be made by the illuminating engineer, starting with watts per square foot, and knowing the lighting units to be employed, and the character of the building to be lighted. This is one of the problems of the illuminating engineer in making industrial lighting specifications; viz., a quick interpolation for given conditions between watts per square foot and average illumination; intensity on the working plane.

Having determined the watts per square foot necessary, the engineer knows the transformer capacity of the installation. He next proceeds to locate the most advantageous centres of distribution for panel boards, and draws out plans for the wiring of the units to these panels, and the wiring of the distributing panels to a main switchboard.

In making up lighting specifications, as few different sizes of lamps as possible should be employed, as this simplifies replacement and storage of renewals.

### Electrical Illumination for Portraiture

An announcement of interest is to the effect that there is being manufactured in Canada a system of electric lighting for photograph studios, called the Viceroy system, for securing photographic results hitherto not obtainable with any

other system of lighting. This system has been in use for some time by photographers in England, and at the recent Photographic Arts and Crafts Exhibition held in London, after very exhaustive tests, it was stated that no daylight studio could hope to compete with this new form of artificial lighting.

The source of light is a series of lamps of special design, the rays emitted being rich in ultra-violet light—one cause of the speed obtainable in the exposure. The regulation is automatic, the lamps requiring no attention whatever while in use. It is claimed that there are no flickers and that the whole studio is flooded with a smooth, even lighting, free from glare.

The lamps are small in size, which admits of their being placed close to the ceiling of any fair sized room. The lamp installation is supported by a light framework attached to the ceiling. This leaves the entire floor of the studio clear, so that the patient or camera can be placed anywhere. It is claimed that this lighting is obtainable with a certainty and rapidity which is a revelation to those accustomed to the tedious adjustments of blinds, screens and reflectors.

One important result claimed for this system is that negatives are obtained in which the harsh shadows under the eyes



Portrait Illumination.

and nostrils, folds in the flesh, wrinkles, etc., are rounded off, thus dispensing with the work of retouching. At the same time the character of the face is preserved without any exaggeration of the features. It is claimed for the system that it practically abolishes the need of retouching.

The intensity of the light reduces the length of time of the exposures to a minimum. With a rapid portrait plate one-quarter of a second only is required, with a lens portrait of  $f/8$ , for children in light costumes, and one second for heads and busts. With lens at  $f/4$  or  $f/3$ , exposures are 4 or 6 times shorter. Thus fully exposed negatives are obtained with shutter exposures. The accompanying illustration is a typical studio with the Viceroy system of illumination installed.

In addition to the 4 ampere and 6.6 ampere pendent type luminous arc lamp, of which there are many thousands in use throughout this country, the Canadian General Electric Company are placing on the market a new pendent unit, known as the Form 8. This unit is similar to the 4 ampere Form 3, except that it takes a different magnetite electrode, which has a life of 350 hours, thus requiring to be trimmed only twelve times per year. This puts the luminous arc lamp, which is a very high efficiency unit, in a class by itself so far as trimming is concerned. New high efficiency electrodes will soon be available for all forms of C. G. E. luminous arc lamps. By the use of these electrodes the efficiency will be improved from twenty to forty per cent., depending on the form of unit, the efficiency in some units being as low as .31 watts per mean hemispherical candle power.



# 150,000-Volt Transmission System

## Some Operating Conditions of the Big Creek Development of the Pacific Light & Power Corporation

By Edward Woodbury\*

The most striking feature of the Big Creek development and transmission is the magnitude of the figures in which the plant data are expressed. In daily operation, 60,000 kw. are generated, utilizing a total hydraulic head of 4,000 ft. in two steps, and transmitted 240 miles at 150,000 volts, thus entailing some conditions of operation which are rather striking.

The transmission line is of course the element of greatest importance in satisfactory commercial operation, although there are many features of engineering interest in the generating and receiving parts of the system.

The most critical problem to be solved proved to be that of regulation. It must be remembered that the inherent regulation of the line alone, without terminal equipment, is from 10 per cent. above power house voltage at no load, to 20 per cent. below at full load; that the effect of the transformer inductive reactance at the generating end practically doubles the boosting at light load, and that the self-exciting characteristics of the generators, when supplying charging current only, tend to produce abnormal voltages at light load.

The complete success of the constant potential or zero regulation system, i.e., operation at the same voltage at the generating and receiving stations, is of particular interest. This result is obtained by the use of synchronous condensers at the receiving end, in conjunction with automatic voltage regulators, one for each condenser as well as for the generators at each of the power houses. Since there are two 15,000 kv.a. condensers and four 17,500 kv.a. generators to be controlled, the regulator problem received most serious consideration, and was made the subject of careful experiment under working conditions before being proved satisfactory, as it now is. It has been found necessary to arrange the regulators to control field currents from a maximum to zero.

In one generating station the excitation system consists of three direct-current units, one of which is the exciter proper, the other two being connected in series opposition, and used to excite the field of the main exciter, Fig. 1. The two units making up the secondary exciter are designed to generate 125 volts and 275 volts respectively. With a potential regulator on the 275-volt unit, arranged with auxiliaries to prevent a reversal of the field in the 125-volt unit of this set, the voltage applied to the exciter field may be changed from that required to give maximum excitation to zero excitation, within a range of voltage on the 275-volt unit, which can be readily handled by the standard alternating-current automatic voltage regulator.

The alternators at the other generator station are excited directly by 200 kw., 250 volt exciters, the main field of which is controlled by a new type of alternating-current automatic voltage regulator, which has no direct-current magnet and which can therefore be adjusted to reduce the exciter voltage to zero. The exciters on this system have three shunt windings on the field, as shown in Fig. 2. One auxiliary field is provided to give the reversed excitation necessary to hold the voltage down when charging the line, the current being supplied to this field, through a variable resistance, by means of a storage battery. The other auxiliary

field, which is solely for the purpose of maintaining the correct polarity, also takes its current, which is small, from the same storage battery.

A reduction of the excitation to zero by means of the potential regulator, has not been necessary at the generating stations, but operation of the synchronous condensers at the receiving station, over the range required, would not be feasible without a complete reduction of the exciter voltage.

With 150,000 volts at the receiving end of the line, the charging current is about 40 per cent. overload for one generator. With normal voltage of 6,600 volts at the generator, the charging current overloads the generator 65 to 70 per cent. Hence in normal operation a line is usually energized by using two generators, under which condition a small field excitation in the normal direction is required. Abnormal conditions sometimes make it necessary to charge the line from a single generator, until the condensers at the receiving station can be started.

The self-exciting characteristics of the system with leading current are such that in one of the generating stations a

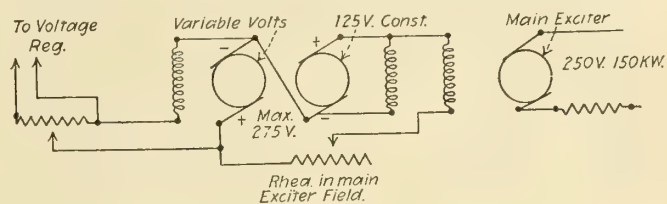


Fig. 1.

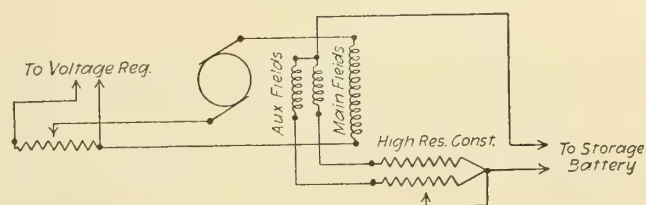


Fig. 2.

single 6,600 volt generator, when connected to an unloaded line without its condenser and run at normal speed with the field switch open, would excite itself to 7,000 volts, corresponding to 176,000 volts on the transmission line at the generating station, and demand from the generators 34,000 kv.a. and 850 actual kilowatts.

At the other station, where the generators were designed by a different manufacturer and had slightly different characteristics, the results were greater and the self-excitation under similar conditions would reach 9,000 volts at the generator or 230,000 volts on the line at the generating end. For this condition the generator would have to deliver 5,000 kw. and about 50,000 kv.a.

Means had therefore to be furnished for using current in a reverse direction in the generator fields to counteract the excitation due to the leading current.

The speed regulation by the waterwheel governor has been excellent, so that no complications have arisen from this source.

As might be expected with a system of this magnitude, special consideration has been given to minimizing the effects

\*Read before the A.I.E.E.



of short circuits. Accordingly, the reactance of the generators of the two manufacturers has been made 70 per cent. and 85 per cent. respectively; of generating station transformers 5 per cent. and 8.5 per cent.; of receiving station transformers 5 per cent. and 8.5 per cent. The result is that the instantaneous short-circuit current is only 330 per cent. of full load on the generators and the sustained short-circuit current 110 per cent. with normal excitation of full load. Under these conditions the waterwheel governors shut off water on short circuit before any serious change in speed can take place.

On account of the use of aluminum cable for the transmission line, it is very desirable to suppress an arc on the line before the wire can be seriously injured; and there is now under consideration the installation of a field-killing relay to be installed in the neutral of the generating station transformers, which will very quickly extinguish the arc and automatically permit the restoration of voltage immediately.

Of the short circuits which have occurred, none have been sufficiently serious to burn down the cable. Some of the outer strands have been scorched, but not sufficiently so to diminish strength. The scorched sections are of course removed at the earliest opportunity.

The causes of the short circuits, which have occurred, may be stated as follows:

1. In the rush of construction, a tree was left standing too close to the line and blew against it. The cable was scorched, but not seriously hurt. This occurred during the tryout period, and while the voltage was returned to normal in a fraction of a minute, the load was transferred to the steam plant, for some time, while experimenting was done to endeavor to locate the trouble.

2. An irrigator tried to clean out a well near the line with a heavy charge of dynamite, blowing a lot of mud and water into the line. The current arced to the ground cable, but did not seriously injure the transmission cable.

3. One of the insulators on a disconnecting switch in one of the stations flashed over.

4. Seven other line short circuits have occurred, five of which have been found to be due to flash-over of insulators, one to be due to an arc from line to a tree during high wind, and the location and cause of the other has not been discovered. In every case of the above, trouble was cleared by reducing the voltage at generators upon current being observed in the ground ammeters, after which service was immediately resumed.

In all cases of insulator flash-overs, the damage to insulators was so slight that service could be resumed, without repairs, immediately on extinguishing the arc. In two cases, two disks out of the string of nine were broken down or badly shattered. In the third case, two of the disks were slightly chipped on the edge.

In the remaining two cases the arcing bars with which the insulator hardware is furnished protected the insulators against any damage. It is found that a flash-over will sometimes burn from one to two inches off the end of the arcing bar, and apparently does not go to the cable unless the direction and strength of the wind are such as to carry the arc out along the cable. The separation of the arcing bars is 51 in., equivalent to a break-down potential of over 500,000 volts at normal frequency.

5. The most serious line interruption was caused by a mechanical defect in a dead-end clamp at the end of a 2,700 ft. span, across a wide and deep river. The weight and tension of the cable make a repair of this kind a serious matter. The clamp which failed was one out of 5,000, so the percentage is not high.

## The Illumination of Festival Hall at the Panama-Pacific International Exposition

Great advancement in the science of artificial lighting has been made by the department of illumination of the Panama-Pacific Exposition in planning an extensive and practical system of indirect lighting to meet the various requirements and physical conditions in grounds and buildings. The scheme adopted for illuminating Festival Hall is a unique method of flood lighting by indirect application. Much of the experimental engineering essential to working out this scheme of illumination was along the lines of pure pioneering in the science of electric lighting. Indirect lighting is occupying attention and testing the skill of electrical engineers the world over, and the advancement shown by the Panama-Pacific Exposition will be an interesting and valuable contribution to electric lighting practice.

The lighting of the various exposition buildings has presented numerous and devious problems and many and unique devices have been employed to illuminate effectively and yet in a manner that will command most favorable attention. To develop a subdued light that will be restful to the eye and still of sufficient strength and effective in all essentials, has been a most difficult task. This has been accomplished in the design adopted for lighting Festival Hall, to a degree surprising even to engineers of long practice. The scheme required special planning in the details.

Festival Hall has a seating capacity of 3,000, to be used for festivals and concerts, and will be almost continuously occupied during the exposition. The architecture is of French theatre design. The auditorium is covered by an immense dome.

A pit, 21 feet square and 12 feet deep, has been constructed under the centre of the auditorium floor. In this pit there are installed ten 18-inch searchlights of enormous power. It would have been relatively simple to arrange the searchlights had there been no obstructions, but the presence of a brick subway essential to the building, situated in the centre of the pit, made it necessary to arrange mirrors to redirect the light from six of the searchlights by reflection into a diffusing disc. The mirrors are placed on either side near the top on the brick subway at an angle necessary to secure the proper reflection. The four other searchlights are so situated that they throw their rays direct into the disc.

The diffusing disc is formed of plate glass, one-quarter inch thick and sand-blasted on the under side. The plate of glass is set in a circular aperture six feet in diameter, forming a collar to the pit. The rays of light from the searchlights are collected in this disc and indirectly diffused through the auditorium. The dome being painted a light color, acts as a reflector, and thus aids effectively in diffusing the light. That is, while the whole interior will be thoroughly lighted, it will be no more evident to the person sitting adjacent, as to the source of illumination than to a person at a distance, unless one is looking downward into the disc. The disc is surrounded by a parapet wall about four feet high and it is so set in the aperture that light will be directed from its surface to every portion of the dome. Conical mirrors are also set around and above the disc to catch any stray rays of light. By using colored screens over the lenses of the searchlights vari-colored lighting effects may be easily secured.

Each of the searchlights is of 6,000,000 candle-power. An enormous amount of heat is necessarily generated and a blast of cold air from the generating system will circulate throughout the pit, passing out above. A stream of water constantly running over the lens of each of the searchlights aids in the cooling. The diffusing disc will be cooled sufficiently by air circulation.

While the lighting of the auditorium is entirely taken



care of by this method, yet suspended fixtures are used in some of the alcoves. The balconies and foyer are lighted by such fixtures.

The footlights on the stage consist of 210 clear lamps and 70 each of amber, blue and red, with a 100-step dimming attachment. A complete portable system is provided by sixteen 300-watt stage pockets. The conference rooms and offices are lighted by small semi-direct units made from staff.

Relief lighting for the cupola above the main dome is accomplished by installing 250-watt units on each storey, placed one foot above the floor. The relief lighting for the pavilion towers has eight 250-watt units placed in the upper portion of each.

The total connected load exclusive of motors amounts to 106 kilowatts.

The construction of an auditorium along conventional lines, lighted by ordinary electrical methods with conventional fixtures and appliances, would have been a comparatively easy task from an engineering viewpoint. Visitors would have been impressed merely with the vastness of the undertaking in accord with the colossal scale of all the architectural construction of the exposition. But originality has been the keynote of the Panama-Pacific Exposition. The engineers selected for the illuminating department, as in other departments, were chosen for their ability to design and construct things new and apart from ordinary standards. The development of new standards in electrical engineering and construction, as in other efforts, for the benefit of present and future builders has been the aim and will prove to be the success of the exposition management.

To have illuminated so great an area on ordinary lines, would require a large number of lights, either suspended or fixed, occupying a considerable portion of space and furnishing imperfect illumination in many details. To make it possible to secure an entirely unobstructed view of the interior of the auditorium from any position, to be able to look upon the magnificent dome of Festival Hall uninterrupted by any disfigurements, is a notable achievement. This has been accomplished, and the visitors to Festival Hall, attracted by the various entertainments, will find that the added attraction of this new, novel and altogether unique method of illumination will make this grand auditorium one of the wonders of the great exposition.

#### One-Man Prepayment Bus Line

The Birmingham Realty Company, of Birmingham, Ala., a few months ago purchased four 15-ft. 6-in. omnibus bodies from The J. G. Brill Company as a means of increasing the transportation facilities to their Norwood property, a highly developed residential section situated about three and one-quarter miles from the centre of the city. During the short period the buses have been in operation, they have given complete satisfaction to the company and have become very popular with patrons on account of affording quick, clean and noiseless transportation; the route traversed is over asphalt streets.

The operation of the buses is on the one-man prepayment method. The door opening is enclosed by two manually operated double-leaf folding doors, which close in conjunction with a single folding step. In addition to operating the doors, the driver also attends to the collection of fares, with the aid of a fare-box located beside his seat, as shown in the above illustration. The roof is the standard plain-arch type, and is equipped with two ventilators, one at each end, located in the top panel. There are also two windows in the front end, the one directly in front of the driver being provided with a stationary weather shield. The sashes throughout are of the two-part type, the upper being stationary and

the lower arranged to raise. The interior is finished in ash, natural finish, with bronze metal trimmings; the ceiling has a carline finish with roof boards showing. Transverse seats, three on each side, are of the stationary back type with 33¼-in. cushions; there is a single seat against the driver's partition, and a full-width seat at the rear end; all these seats are upholstered in twill-woven rattan, and provide a seating capacity of 18, which is the number for this size and weight of body. The driver's seat is upholstered in leather. The two-ton Pierce-Arrow chassis has a wheel base of 15 ft., and the wheels are 36 ins. in diameter. The body weighs 2,600 lbs., and the chassis 5,600 lbs.

The underframe is of Brill standard construction and built entirely of ash. The side sills are 2¼ by 4 in.; the built end sill 1¾ by 4 in.; the rear end sill 1¾ by 5½ in.; there are three crossings 1¾ by 3 in., and four 1¾ by 1¾ in.; the latter attached to 3-in. channels form furring to which the floor boards are attached.

The corner and side posts in the upper framing are also of ash, 3½ by 1½ in., respectively. The entire construction and equipment are modern, and the buses present an excellent appearance.

#### Some Newly Worded Warnings

From the time you start to leave the car till you reach the sidewalk never stop looking for danger.

Don't hesitate in front of a car, it confuses the motor-man. Go forward or back in a decided manner.

When you stop to think be sure to stop in a safe place.

Get in and out of a car quickly, but don't hurry—hurrying is dangerous and sometimes fatal.

Don't let a child under eight cross a trolley car street alone.

If you don't warn and take care, your child may be maimed or killed, no matter how much we warn and take care.

Double your watchfulness when you cross a double-track street.

#### Personal

**Mr. R. D. S. Beckstedt** has been appointed superintendent of the Tagona Water and Light Company, Sault Ste. Marie, succeeding Mr. R. A. Campbell.

**Mr. J. C. Ross** has succeeded Mr. Henry Dodue as chief engineer of the Yarmouth Light & Power Company, of Yarmouth, N.S.

**Mr. F. W. Moneur**, sales manager of the Canadian Tungsten Lamp Company, Limited, of Hamilton, Ont., has resigned his position, effective October 1st.

**Mr. H. W. Scott**, manager of the Montreal office of the Jeffrey Manufacturing Company, has resigned to establish himself in the engineering and contracting business.

**Mr. M. W. Sherwood**, assistant sales manager for many years at the Columbus, Ohio, factory of the Jeffrey Manufacturing Company, has been placed in charge of their Montreal office.

**Mr. Wm. Somers**, formerly electrical inspector for Pe-trolea has been appointed to a similar office in Chatham. Mr. Somers will also have charge of suburban towns located within easy travelling distance of Chatham, such as Wallaceburg and Dresden.

**Mr. John Hare**, superintendent of the Barrie Municipal Electric System, met with a serious accident recently. The Barrie power supply enters the Barrie sub-station, from Severn River, at 25,000 volts, and it was this line Mr. Hare came in contact with. After a few days' forced rest, we understand he is back on the job, a somewhat scarred but wiser superintendent.



# The Dealer and Contractor

## Valuable Suggestions for Getting and Carrying Out a Wiring Contract\*

In this article the fundamental idea is to outline what to the writer would appear to be a proper manner of working up a prospective job, of laying it out, of preparing the estimate, and finally after receiving the contract, of doing the work, sending in the bill and collecting the money. In other words, a complete wiring transaction from the time the customer makes his first inquiry to the time the transaction has been carried through and completed.

The house owner has for some time been impressed with the desirability of electric service for his home, and has finally come to the point where having noticed the attractive and aggressive advertising of one of his home electrical contractors, he has come to the conclusion that he will send for this man and find out just what it will cost to install this service in his home.

The contractor when arriving at the home or office of the prospective customer, finds that the owner has not mapped out any definite ideas, either with respect to the amount of current he requires, or the kind of a system he wishes installed. Let us begin at this point therefore, and suggest a manner in which this may be taken up.

We begin by indicating that the cost of wiring a building may vary between wide limits. The cheap method consists of what is known as knob and tube work, and is usually accompanied by overhead service and meter and a minimum number of switches and receptacles. The good method consists of a BX job with a proper proportion of switches and receptacles, together with a reasonable allowance for future increase. With respect to knob and tube work, let it be said at the outset, that in but few cases will it be found necessary to install work of this character if a proper presentation be made of all the advantages and benefits of flexible steel. The knob and tube job can be installed somewhat more cheaply, but the difference is not nearly so great as is frequently imagined. As a general proposition, it may be stated that with the same degree of experience in installing both classes of work, a BX job may be installed on an average cost of not more than 40 per cent. in excess of the knob and tube. Especially is this true where three-way switches are involved. In about two cases out of three, an owner will pay this difference, provided the great advantages of the better system are made clear to him.

In the first place, the material is practically permanent. It is fool proof. It cannot be tampered with without proper tools and experience, and is therefore, safer. It can be installed with a great deal less tearing up, since a 2-inch floor board will easily accommodate 2 or more circuits. In running double three-way circuits through halls, the knob and tube work frequently requires taking up three or four feet. Furthermore, with a knob and tube job at each outlet it is necessary to cut the plaster away, with the result that there is constantly a working loose of the plaster for many years

after. Furthermore, it opens the ceiling and adds to the fire risk. With a BX system, the outlet is closed by a steel box and is finished off in a workmanlike manner. While the proposition of rats gnawing off the insulation of a wire may seem more or less mythical, the writer has seen No. 14 copper wire completely cut in half by rats, and the insulation eaten off for a considerable distance. This is impossible with a BX installation.

The risk of shock is also less with a properly grounded BX system and with nervous or sickly persons, this is an important point.

The service in all cases should be brought in to the basement. In many localities the upstairs meter is prohibited. Even if not however against the company's regulations, under all ordinary conditions, the proper place is the basement. In many cases, and where the pole is close to the building, the strictly underground service is strongly to be recommended. The owner will appreciate this suggestion afterwards, if he does not at the time. Under ordinary conditions, however, it will be necessary to jump the service to the house, and in that case the service conduit should extend to the eaves of the building, in no case should be stopped half way up, or in the middle of a blank space. The greatly improved appearance of a conduit in which the service cap is under the eaves, or some corresponding point on the building, easily compensates for the slight additional cost.

The distribution cabinet or cutout box should be located in the basement. The practice which has survived for many years, and which is a relic of the older days of No. 12 wire for branch circuits and Carbon lamps with their large current consumption, not to speak of the crowding of these branch circuits, follows a condition which no longer exists, and a custom which certainly should be obsolete. Manifestly the cost of the ordinary steel box in the basement is less by one-half to two-thirds than the flush wall box in the second hall or closet with its door front. Also manifestly, the cost of carrying the circuits to the basement box is less than they would be to the second floor box. Finally, the convenience and desirability of the arrangement, to the customer, is much greater, since it is not necessary to have the repair man come into the house, always at the most inopportune time to make repairs when the lights are out. This is work which should be done in the basement. For these reasons, we invariably recommend the basement box. Another advantage on the side of economy, is that in a great majority of cases, it is quite a little cheaper from the standpoint of actual material involved, than would be the case of the upstairs box.

It is an excellent plan in connection with a meter loop, to purchase standard meter boards, rather than leave your men to nail up broken boxes or other material, which they may find on the job. The effect of the lighting company also is good, and it adds to your reputation in giving a finish to the job and indicating a thoughtfulness for details which is frequently absent in your competitor. These meter

\* From National Electrical Contractor.



boards may be purchased for a small sum, not over 25 cents, and surely this item is one which any job will stand.

Do not crowd your circuits. If your lights total 32, do not place them on two circuits, even though the rules will permit. It is much better to split this into at least three circuits, and thereby allow the owner room for extensions without relatively high cost after the original work is completed. Frequently, the addition of an extra circuit means absolutely nothing in branch wiring, and is simply summed up in a matter of 15 or 20 cents for a double branch block in place of a single.

When you take up the matter of switches, there are several points to be considered. First, do not install snap switches in any case except where there may be dampness and the appearance does not count. Secondly, use nothing but the highest grade of flush push button switch. Preferably, use solid plates, especially where it is a case of a house already built. An experienced eye will detect a struck-up plate every time, and the excuse given that it is in reality better because inequalities of wall surface in most cases suggest the use of such a plan, is in reality a confession of faulty work. In no case need this condition affect the job adversely, provided the switch is not set too far front.

In recommending switches, we should bear in mind that invariably the mistake is in supplying too few and not too many switches. Certainly, there should be a three-way circuit for the front portion of the house, and also the rear servants' stairs, if the owner can be induced to install it. Do not forget that switches save money every day in the year, and that their first cost is the last cost. This argument appeals to any house owner, although they may not think of it if you do not mention it. The switch for the dining room is a necessity, since the average maid cannot reach across the table to the fixture. If she does, it is usually at the risk of breaking glass or china. Furthermore, bear in mind that the tendency to-day is very largely towards fixtures close to the ceiling, particularly not the low pendant type we have been familiar with for many years and in all such cases, therefore, we are obliged to use the switch. If it be suggested that chain sockets may be used, this may be disposed of with the statement that they are highly inartistic and particularly mar the effect of a fixture which is high up. Also they are mechanically defective, in that with ordinary careless handling, the chains frequently break. A chain pull socket under such circumstances is an excuse and attribute to poor workmanship.

In bedrooms where there are side brackets, we should invariably recommend switches where these brackets are on the opposite sides of the room, since intervening furniture makes it necessary to go through the room in the dark. In addition to the fact that many women are timid about entering bedrooms in the dark, especially if alone in the house, the added reason of stumbling over furniture frequently decides the question.

With respect to closets, by all means recommend a light if these closets are of sufficient size to warrant it. The closet light next to the cellar switch is the greatest convenience in the house, and one for which the owner will remember you longest.

#### Many Advantages of Receptacles

With flush receptacles, by all means do not fail to present the many advantages which these devices possess.

Do not fail to locate at least one on each principal floor for the vacuum cleaner. If the owner hasn't a vacuum cleaner, he almost certainly will have following his introduction of electric service. Frequently if the work has to be cut down in cost, these may be made to serve a double purpose by locating one in the dining room conveniently near the serving table. This will usually reach most places on the

first floor, and will at the same time afford a proper connection for heating and cooking devices. In this same connection, and for the same reason, locate a receptacle in the laundry or kitchen, as the case may be. Call attention to the fact in locating flush receptacles for these purposes, that while most electrical devices are advertised as being convenient for connection to an electric socket, in no case does it pay to so use them. The capacity of the wire in a fixture, usually No. 18, as compared with the capacity of the circuit wire in a receptacle, which is No. 14, is such that motor driven devices do not receive proper voltage, owing to the small size of the wire and heating devices for the same reason are deprived of a proper voltage. In the case of the motor, it means reduced speed, and therefore, reduced capacity and in the case of the heating device, it means a great impairment of the efficiency of the apparatus, especially the speed.

The result in both cases is a considerable increase in the cost of the apparatus, or rather the use of it to the customer. If these arguments be advanced, it is a very easy matter to obtain the owner's consent to installing at least a limited number of receptacles.

The type of receptacle should preferably be one in which the condition of the receptacle is always closed. That is to say, one that presents a flat surface and not a recessed pocket. A receptacle of the Hubbell type for example. The advantage of this, in addition to the more attractive appearance, lies in the fact that children may not stick scissors or other similar devices in these receptacles and thereby cause either serious damage to themselves or to the house. Another advantage of a receptacle of this type, lies in the fact that used in connection with the adapters that are furnished, the customer may use many devices anywhere in the house, whether on a receptacle or a fixture socket. This is frequently a great advantage, especially where lamps and other little special devices are purchased by customer when in other cities, and then brought home only to find that he cannot attach them to his system. It is well to standardize on some one receptacle rather than carry two or three in stock. You will find that your workmen at times when you are not in touch with matters, will quite frequently install two different makes of receptacles in the same house, with the consequent wrath of the owner coming back on you.

In connection with the receptacles, it is well for the reasons above stated to place them on a separate circuit, running No. 12 wire. It is not possible to fuse a receptacle circuit and come within the limits prescribed for branch circuit lighting, without constant trouble with the fuses blowing because the owner attempts to attach a chafing dish, or a radiator. For these reasons, it is best to install a circuit of larger capacity, and this can best be done by putting the receptacles on a circuit by themselves.

In figuring three-way circuits, bear in mind that the upstairs lighting is frequently a bracket fixture. In this case also, it frequently happens the switch would ordinarily come within a foot or two of the fixture. In such cases invariably employ a three-way socket on the fixture. This does away with the switch, and in addition to saving an item on the wiring cost, which is transferred in part to fixture cost, it makes a better appearing installation, and one equally satisfactory.

In figuring capacity of your mains, be careful not to spoil the good ideas you have introduced into the job elsewhere, by paring down at this point. Figure the total load on your house in amperes, and if the building is more or less completely wired at the outset, put in a wire of at least this capacity as indicated in the National Code. I am aware in suggesting this, that many contractors take a load factor in residences of not over 50 per cent. and if their connected



load therefore, amounts to 50 amperes, they would figure on a wire of 25 amperes capacity.

This is at variance with the modern idea and the educational plan which is being followed out of a proper provision in house wiring for the increasing use of electric service devices. The rapid addition to the list of electrical household devices such as heating and cooking devices, electric irons, vacuum cleaners, motors for utility purposes, washing machines, ironing machines, and many other devices which are constantly being developed, makes it absolutely necessary that the electrical contractor look ahead and safeguard the interests of his customer, certainly to a reasonable extent, by providing ample capacity in the service wires.

Apart from this, consider for a moment that No. 10 wire with a capacity of 30 amperes and which would usually take care of any of the ordinary small residences, as compared with the No. 8 wire with a capacity of 50 amperes—an increase of 70 per cent.—and of which the difference in price on the 100 ft. of wire which would cover the average service, amounts to an insignificant sum.

If the owner, admitting the desirability and even the necessity for these excellent suggestions which you have made, is unable to pay for all of them at the particular time, let your service wires by all means provide the ultimate capacity required, and also arrange your cutout box of a size to provide for ample additions in the way of further branch circuits. Also, and if there is any appreciable cutting in the lighting for the upper floors with an idea that later on more wiring will be installed, it is frequently desirable to place a reduced number of lights on these upstairs circuits, so that extensions may be made later without the necessity for running new circuits from the basement.

In going over these matters with your prospective customer, you will present them in a careful, thorough and painstaking manner, and not fail to call his attention to the fact that this work naturally costs more than inferior work, and that especially in electric wiring it is true that nothing but the best is good enough. Anything else is hazardous, and will invariably prove to be unsatisfactory. Make clear to him that you can install his wiring with as little cost within reason as he feels he is able to spend, but that, however you may install it, you have but one standard of work, and that is the best. Undoubtedly many ideas other than those above mentioned will occur to you on reading of this suggested line of talk but when all has been said the fact remains that if you will adopt as your standard a high class of workmanship, the best for your customer, and will see that people who entrust their work with you are given the benefit, not only of the best work and materials, but of the best ideas at the time prevailing in modern electric service, you will build up a business for yourself, which will in a sense defy competition. You will find people will come to you because of the fertility of your ideas, and your reputation for high grade work and fair dealing. This means not only a good business, but a profitable business, and after all that is the goal which we all seek.

### Joint Orders a Pernicious Principle

Editor, Electrical News:

In a recent issue of the Electrical News (Aug. 15) appears a news item to the effect that the Canadian Electrical Association is taking steps toward placing joint orders for electrical supplies.

It is regrettable that the attitude of the C. E. A. could not be more fully reported at that time, for a practice so pernicious in principle as that proposed should certainly be nipped in the bud. It is hoped that a discussion of the subject will aid that end.

As far as the present report goes, most of the member companies of the C. E. A. apparently feel that they will benefit themselves by this practice and be able to extend that benefit also to "the man on the street who buys electrical utilities and supplies from the organization which supplies him with light and power."

This wording is somewhat ambiguous, for "the man on the street" may refer to the ultimate consumer or the so-called screwdriver or curbstone electrician—species carpetbagger. But whatever construction is intended, the proposed practice must make for the elimination of the jobber and dealer through direct purchase from the manufacturer. This is the certain outcome of co-operative buying.

In a country of extensive municipal ownership of public utilities it would also tend toward municipal trading as due to the desire for self-preservation on the part of these plants they would have to follow the lead of the private corporation members of the C. E. A. Its influence would be along the line of an extension of municipal ownership.

All are agreed that in the interests of a perfect, which is to say continuous, service, the screwdriver electrician should not exactly be encouraged. On the assumption that a considerable impetus has been given to the electrical supply business by private enterprise, the scheme proposed might confer an immediate temporary advantage—a kind of theft of the reward of initiative and enterprise—especially (opposite as the statement at first appears) if launched in times of general prosperity. It might in some isolated instances prove a permanent advantage, but would in general speedily degenerate into the clog which conservatism naturally is. It must be remembered however that the combined efforts of the electrical jobbers and dealers as distributors, especially if aided by active co-operation on the part of the central station, have achieved a considerable measure of success in advancing the progressive use of electrical energy. The province of the jobber has been largely one of financing the dealer who from myriad centres distributes the various electrical appliances and energy using devices to the ultimate consumer. Large business institutions have come into growth as a consequence and these have borne the brunt of the cost of progress as many valueless stocks of unsalable obsolete material go to show. Private enterprise plus competition compels all to keep pace with progress no matter what the cost.

This does not, however, result in a direct tax upon all consumers, but it is possible that whatever money is invested by central stations in this proposed supply business would become part of their capital and as such entitled to and expectant of an annual return.

This situation has a parallel in the case of the consumer of "juice" from a municipal plant who gets a low kilowatt-hour rate but pays more than the difference in interest on bonds and so forth. Even though economy of distribution obtain it would be undesirable if the quality of the service rendered by the distributors were thereby impaired. The elimination of the numerous middlemen would certainly reduce the number of distributing centres; of skilled salesmen (sales engineers); and would make for delay. Loss of time is an infinite expense.

Co-operation in the sale or purchase of commodities is undesirable. Municipal ownership may be used, almost without exception, to show that co-operation may mean conservatism and make for business stagnation. Co-operation should obtain in the perfecting of product and in the determination of that which is most desirable, and competition in the marketing of that product both now and always. Competition eliminates the sluggard and viewed rightly makes for business health and acuity. This is the nation's prosperity.

A central station can show interest in its customers



best by disseminating information among them regarding the scope, use and desirability of electric appliances; the proper method of installation and their economic use. Such educational work is a legitimate sales expense and would prove an advantage to all. Where invention causes such rapid changes and the sale of electric energy is to be practically perpetual, it should certainly become an important part of central station service.

To-day, the average central station sales force is lacking in enterprise and is running on the momentum of the past aided by the effort expended by the jobber and dealer introducing new and improved lines. The central station should create business for those concerns legitimately engaged in the supply business, or this would net big returns. Increased current consumption without any appreciable increase in investment is the principal advantage to the central station.

The final outcome desired by the C. E. A., viz., standardization, is also a questionable advantage, for extreme standardization impedes progress. Manufacturers' associations and engineering societies are keenly alive to the requirements of this situation and may well be entrusted with its solution, but no matter how selfishly they may be inclined, they will certainly not endeavour to so standardize purchases that whatever is new, will be excluded. This too is a possibility of the plan of the C. E. A.

This letter caroms pretty well all around and over the subject, but should it start a discussion its object will have been achieved. Knowing that you have the interests of the jobber, the dealer, and the central station at heart, a discussion of this subject should be started through the channels of the Electrical News that all may be benefitted to the fullest extent by whatever action is finally decided upon by the Canadian Electrical Association.

Yours very truly,

H. E. Grant.

Vancouver, B.C.,  
September 15, 1914.

### Getting Old Houses Wired

An interesting paper was recently presented by Mr. E. C. Kimball of the Boston Edison Company before the New England Section of the National Electric Light Association, describing a campaign carried on by this company to secure the installation of electrical equipment in old houses that had not been wired. The paper describes a "single outlet" offer made to this class of consumer, which included one outlet for each customer at any desired point on the ground floor and for which the customer contracted to pay \$2.35 down and \$2.00 per month for six months. The idea underlying this offer was that a more complete installation would be immediately required and the results show that, in the nine months ending July 31st, 1914, the company signed 918 new contracts, adding 7,000 50-watt equivalents to the connected load, for which the estimated income is \$21,000. Of the 918 contracts obtained, only 29 were for the single outlet alone. Individual equipment was ordered varying all the way up to \$200 and the average contract amounted to approximately \$83. It is calculated that the company's financial investment will be taken care of in 15 months.

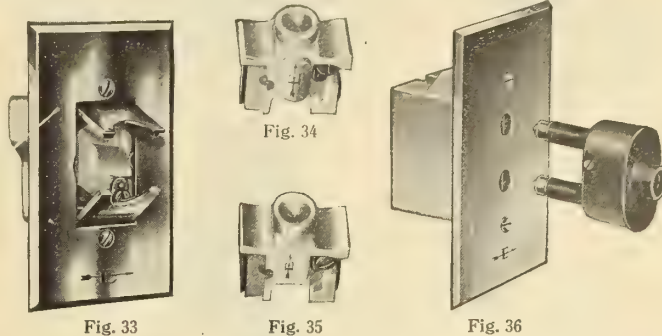
The paper states that the wiring contractors in the city were not favorable to this plan at first, but that later they have quite fallen in with idea and are willing to do the work at the arbitrary price named by the company. Indeed, it is said a number of these contractors keep in daily touch with the company, to see if any new work is offering. These contractors, in fact, are advance agents for the company, and are encouraged to bring in new work by being allowed \$2.00 for each new customer secured, plus 25c. for each outlet

the customer contracts for. In this way 248 contracts have been obtained at a compensation of \$1,265, or at the rate of \$5.10 per house.

### More Flush Receptacles

Further illustrations of the various types of flush base-board receptacles, in addition to those in our issue of September 15th, are given below.

Fig. 33 shows a receptacle manufactured by the Arrow Electric Company. Figs. 34 and 35 are the plugs for this receptacle. The inside of the receptacle is grooved so that it



can be used with a polarity plug as well as with the standard plug. This is an advantage where a fixed polarity of current is required. The standard plug illustrated is interchangeable with other makes of plug of this design.

Fig. 36 is an Arrow automatic door receptacle. The doors in the plate open and close automatically with the insertion and removal of the plug. These doors prevent dust and moisture from getting into the interior of the receptacle, and conceal the live contacts when not in use.

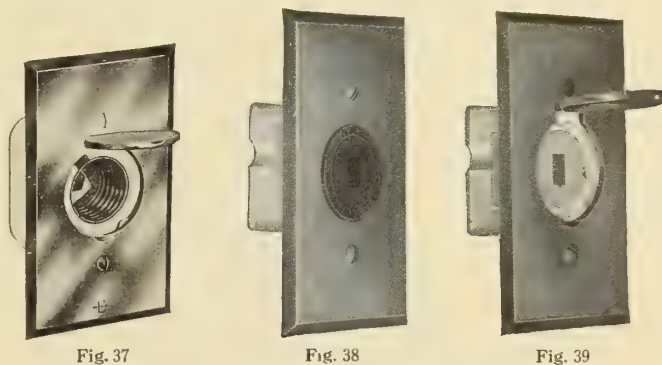


Fig. 37 is a screw plug flush receptacle, also manufactured by the Arrow Electric Company. This unit is adapted for use with any standard Edison base attachment plug. The plate shown is made with a hinged door so that the interior of the receptacle may be covered up when not in use. The Arrow E line is handled in Canada by the Northern Electric Company.

Fig. 38 is a type of separable plug receptacle manufactured by the H. T. Paiste Company. The opening in this receptacle is rectangular in shape which, it is claimed, renders it easier to find the opening and insert the plug as, for example, when the receptacle may be wired in a dark corner. The contact springs are in the base, safe from breaking or bending. These are phosphor bronze to ensure long life and a firm and even grip.

Fig. 39 represents a receptacle similar to Fig. 38, except that the contact part of the face recedes slightly and is covered by a folding door, improving both the appearance, the cleanliness and the safety of this receptacle.

Fig. 40 is similar to Fig. 38, except that the rectangular base is replaced by a round base.

Fig. 41 is a Paiste receptacle adapted for a screw plug.



When the plug is removed, a door fits down as in Fig. 39.

Fig. 42 represents the plug used with Figs. 38, 39 and 40.



Fig. 40

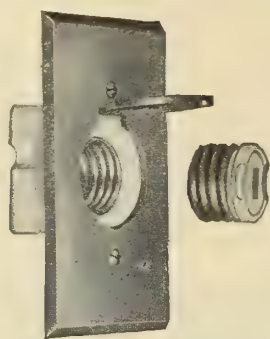


Fig. 41



Fig. 42



Fig. 43

In this figure the strain relief wiring is indicated, before the protecting fibre is pushed on.

Fig. 43 represents the well-known Diamond H flush receptacle.

#### Gain to Canadian Manufacturer

As noted in our last issue, Boving & Company of Canada have secured an order for two hydraulic presses from the Electric Power Company for the Northumberland Pulp Company, a subsidiary. Boving & Company are also building a similar press for a company in New Brunswick. These presses have special features worthy of comment, as they are more or less designed on the latest and most approved German practice, where the building of hydraulic presses has been brought to a very high state of perfection. Incidentally, this illustrates one of the advantages certain to accrue to Canada from the present appalling European war, inasmuch as, in the ordinary course of events, these presses could be imported from Germany at a lower price than they could be produced here in Canada, and, consequently, the order would likely have gone to the foreign country.

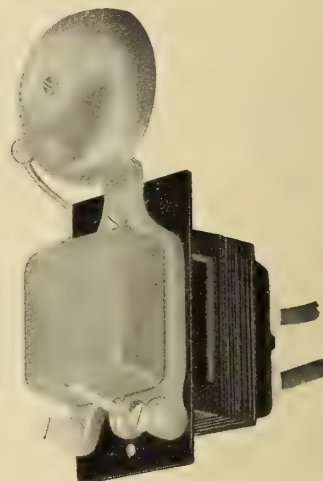
No cast iron enters into the construction of these presses, the material being entirely of steel throughout; no foundations are necessary. These presses are not subject to any deformations due to the stresses to which hydraulic presses are generally put, and have a very high factor of safety. They are suitable for all purposes for which hydraulic presses are required and, while costing slightly more than the imported German article, are nevertheless cheaper than the ordinary hydraulic presses usually constructed on this continent. These presses can be built up to 1,500,000 lbs. pressure.

**Hylo Mazda Lamp.**—The well-known Hylo lamp with carbon filaments has now been duplicated in the higher efficiency tungsten lamp. The large filament in this lamp takes approximately 25 watts and gives 20 c.p. The small filament gives about 1 c.p. with a use of about 15 per cent. as much energy, or say 4 watts. Though this is not a particularly efficient low light, it is a considerable saving over burning a high c.p., and is also much more agreeable where a night light is required. These lamps are manufactured by the

Economical Electric Lamp Division, National Quality Lamp Works of the General Electric Company, New York City, N.Y.

#### Transformer Fits Standard Box

The Transformer illustrated herewith is designed to be installed in a Standard flush switch box for flush work or they may be reversed and mounted on the surface in the regular way. They are of special value for residences where it is desirable to place the transformer near the bell and where the ordinary transformer would be unsightly. The transformer plate is drilled and tapped to take any standard iron box bell. It will also take a standard flush switch plate where it is desired to make the finish conform to finish of the hardware.



The coils are independently wound and designed to withstand a 2,500 volt insulation test between primary and secondary and primary and ground, also 1,000 volts between secondary and ground. The transformer will not burn out on a continuous short circuit of the secondary. Frequency, 60 cycles—primary voltage 110, secondary voltage 10. It is constructed to comply with the National Electric Code and is approved. Manufactured by A. E. Rittenhouse Company, Honeoye Falls, N.Y.

#### New Line of Cable

The Trumbull Electric Manufacturing Company, Plainville, Conn., are placing on the market a new line of armored cable illustrated in the accompanying cut. This new line is known as the Trumbull T armored cable, flexible steel conduit and armored cord. It is claimed to be high-grade in every particular, made in their own factory under standard



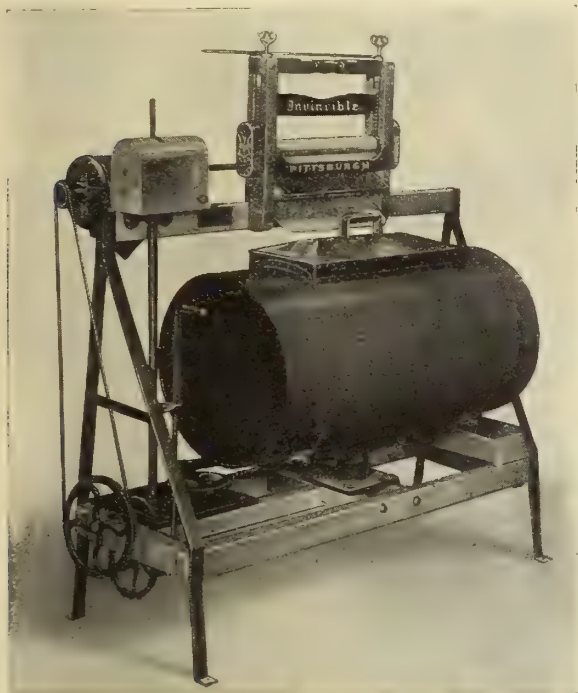
conditions with the best machinery obtainable. The firm say it is as flexible as any on the market and more flexible than most. This line can be furnished in either twin or three conductor type, in stranded wire or lead covered.

The Monarch Electric Company, St. Lambert, P.Q., have recently placed on the market a new type of pull chain, pendant socket of very substantial and simple construction.



### A New Electric Washing Machine

The Invincible Manufacturing Company, Pittsburgh, have recently put on the market a washing machine of an entirely new type. The clothes are placed in a cylinder, but instead of revolving in the usual manner the cylinder of this washer oscillates on its vertical axis. This motion drives the suds back and forth and subjects the clothes to a very vigorous cleaning action. Furthermore, there is no tendency for the clothes to form into a ball; in fact clothes tightly matted together can be put into the cylinder and the machine will untangle them. A special feature is a perforated box which



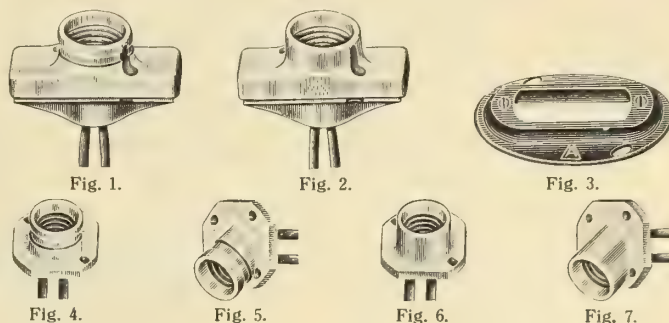
runs along the bottom of the cylinder; at this point the suds are practically quiet so that all sand, grit and foreign matter collects here, without being constantly distributed through the clothes, and can be run off through the drain cock. The wringer is reversible and has a quick release by means of which the pressure on the rollers can be instantly released should the clothes tangle or the fingers be caught. The cylinder is of copper, heavily tinned inside. The drive is very simple and offers no danger to the most careless operator. Power is supplied by a  $\frac{1}{8}$  h.p. Westinghouse motor, which can operate wringer and washer at the same time.

### A Water Power Act

The United States House of Representatives have passed a water power act known as the Adamson Bill, and the matter will now be considered by the Senate. As the bill now reads, it outlines a practical and well-defined programme by which water powers on navigable rivers can be utilized. It provides that the Secretary of War can authorize developments in accordance with plans approved by the chief of United States engineers. This guarantees that navigation interests are conserved, the greatest power possibilities utilized, and the commercial character of the enterprise safeguarded against abuses frequently associated with trusts. The water power privilege thus granted runs for a period of 50 years, after which the government may take over the plant, together with the transmission and distribution system, on a fair business basis. The government does not propose to exact any tax for the water power privilege, but a proper share is to be paid for betterments of flow conditions resulting from government storage or regulating works.

### New Receptacle Fittings

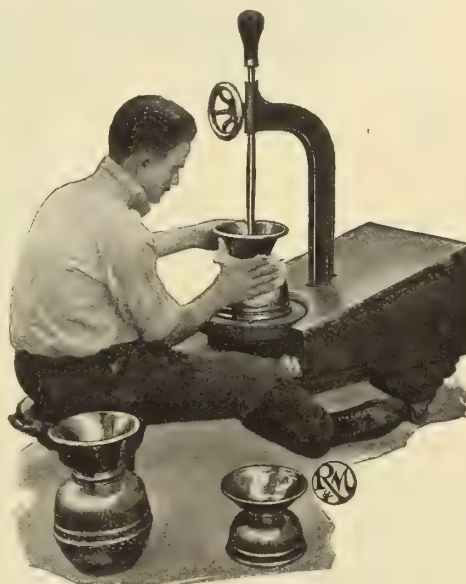
The accompanying figures show a number of newly approved standard receptacle fittings being placed on the market by the Appleton Electric Company, Chicago. Fig. 1 represents a one-piece weatherproof, porcelain receptacle for use on  $\frac{1}{2}$  in.,  $\frac{3}{4}$  in. and 1 in. rectangular steel unilets; note the shade-holder groove. Fig. 2 is same as Fig. 1 but without the shade-holder groove. These receptacles are secured to the body with two screws. Figs. 4 and 5 represent one-



piece, weatherproof, porcelain receptacles with shade-holder groove, for use on  $\frac{1}{2}$  in.,  $\frac{3}{4}$  in. and 1 in. octagonal steel unilets; secured to body with two screws. Figs. 6 and 7 also represent straight and angular types of this receptacle, without the shade-holder groove. Fig. 3 is a push-button switch cover for use on a 4-in. round outlet box. It will take any of the standard push-button switches, flush rotary switches or plug receptacles.

### Electric Cuspidor Polisher

The Helcomb electric cuspidor polisher, illustrated herewith, is one of the latest electrical time savers for use in the office building, hotel, public building or factory. This outfit has changed a job which formerly took a lot of time and hard labor into a task of but a few minutes. It is claimed by the manufacturers that the average time of pol-



ishing a cuspidor with the outfit is about one-half minute. It is also claimed that it eliminates the danger of denting the metal and that a much higher polish can be obtained than is ordinarily possible where cuspidors are polished by hand. In the large building where there are hundreds of cuspidors to be polished every few days, the saving in time and labor is a very considerable item. The outfit is manufactured by the J. I. Helcomb Manufacturing Company, Indianapolis, Ind. It consists of a rotating disc with an



automatic centering clamping device which holds the cuspidor. The cuspidor is held against a revolving disc by a plunger supported from an iron brace above. The plunger rod does not turn, the block on the end of the plunger being mounted on a belt of ball bearings. The disc is belt-driven by a motor which is mounted in the base of the truck. The truck is made of oak and is mounted on light running rubber tired castors. In addition to the disc for holding cuspidors, the outfit is supplied with a buffing wheel and grinding disc, for buffing silverware, grinding cutlery, etc. When used as a grinder or buffer the outfit is stood on end. The outfits are equipped with one-quarter horse power, 1,750 r.p.m. motors, manufactured by the Robins & Myers Company, Springfield, Ohio.

#### Multi-Point Switch for Electric Ranges

A new snap switch brought out by the Bryant Electric Company, of Bridgeport, Conn., for use with electric ranges and other heating appliances is arranged to be so connected that instead of increasing the number of coils or elements in circuit beginning with "low heat," as has been the general practice heretofore, the new arrangement gives the greatest heat in the first position of the switch. In other words, be-



Multi-Point Snap Switch for Heating Devices.

ginning with the switch in its "off" position, the first twist of the knob throws into circuit all the heating elements it controls. The second position cuts the heat down to medium, the third to low, and the fourth is the "off" position. In this way the degrees of heat are provided in the order in which they are most frequently desired, the heating device is more quickly brought to full operating temperature, and, since the current to be broken at any step is small, a very much smaller and more compact switch can be used. An indicating dial, showing the position of the switch, is set at an angle of 45 deg. so as to be visible from any position in front of or above the switch.

The Cutler-Hammer Manufacturing Company announce that the first Cutler-Hammer electric steering gear to be used in a foreign navy, is on the Greek battleship "Kilkis." This ship, purchased from the United States, was formerly U.S.S. "Mississippi." The "Kilkis" is reported as having arrived safely at Athens.

Pass & Seymour, Inc., are distributing, in miniature form, a photographic reproduction of their catalogue No. 22. The prime object of the smaller catalogue is to provide information in a vest-pocket size, which does not unduly crowd the pocket, and which one can have always on hand.

#### Trade Publications

**Progressive Manager.**—Folder issued by the Transmission Engineering Company, Pittsburgh, Pa., illustrating their outdoor switching stations.

**Electric Heaters.**—The National Electric Heating Company of Toronto are getting out a new circular on electric ranges, air heaters and luminous radiators.

**Strain Insulators and Clamps.**—Bulletin No. A 4200, issued by the Canadian General Electric Company, describing and illustrating strain insulators and strain clamps.

**Unilets conduit fittings.**—small booklet issued by the Appleton Electric Company, Chicago, Illinois, fully listing and illustrating their complete line of these well-known fittings.

**Rail Bonds.**—Bulletin issued by Canadian General Electric Company, Limited, describing rail bonds and rail bond tools and giving a large amount of valuable engineering data on the subject.

**Electrical Machinery.**—Catalogue issued by MacGovern & Company, Inc., 114 Liberty Street, New York, listing and describing used electrical and steam machinery, cars, car equipment, etc., carried in stock at the present time by this company. The booklet answers any prejudice against the purchase of used equipment by publishing a long list of prominent companies and others to whom they have sold apparatus.

**Small Lighting and Charging Units.**—Booklet issued by the E. L. Russell Company, Indianapolis, Ind., describing their small lighting and charging units for service in districts where electricity is not available or where the cost of current is high. These units consist of a "silent valve," single or twin-cylinder engine, depending upon the capacity of the generator. The standard size lighting units have capacities of 35, 75 and 150 16 c.p. lamps.

**Electric Heating.**—Catalogue No. 19 issued by the Simplex Electric Heating Company, Belleville, Ont., illustrating and describing their complete line of standard heating apparatus, including several new heaters for various commercial purposes. The first 40 pages are given up to household devices and ranges, and the balance of the catalogue, some 55 pages, shows purely commercial apparatus and indicates a great number of factory lines useful where electric current is available.

**Direct Current Test Meter.**—Bulletin 46390 issued by Canadian General Electric Company describes a portable test meter combining in one standard several capacities covering a range from light load to full load which makes possible rapid testing since no time is lost in changing standards. The electrical element is similar in design to that in other C. G. E. direct current meters. The meter is furnished in two distinct ampere ratings, 1, 2, 10, 20, 40 ampere or 5, 10, 50, 100 ampere each with single 110 volt or double 110/220 volt potential windings.

**Ornamental Incandescent Street Lighting.**—Bulletin B-3310 issued by Canadian General Electric Company describes the Novalux units recently added to their line of ornamental street lighting fixtures. They are made for both series and multiple operation and will accommodate the 400 to 600 c.p. 6.6 ampere and the 600 and 1,000 c.p., 20 ampere sizes of series mazda lamps and the 500, 750 and 1,000 watt multiple mazda lamps. The individual compensator mounted inside the ornamental casing of the series unit permits the use of the 20 ampere mazda lamps on 6.6 or 7.5 ampere circuits. As the efficiency of this high current lamp is much better than the straight series, about 25 per cent. energy is saved. This allows the Series Novalux Ornamental Units to be connected in existing circuits and permits an additional number of lights to be used without adding to the station equipment.



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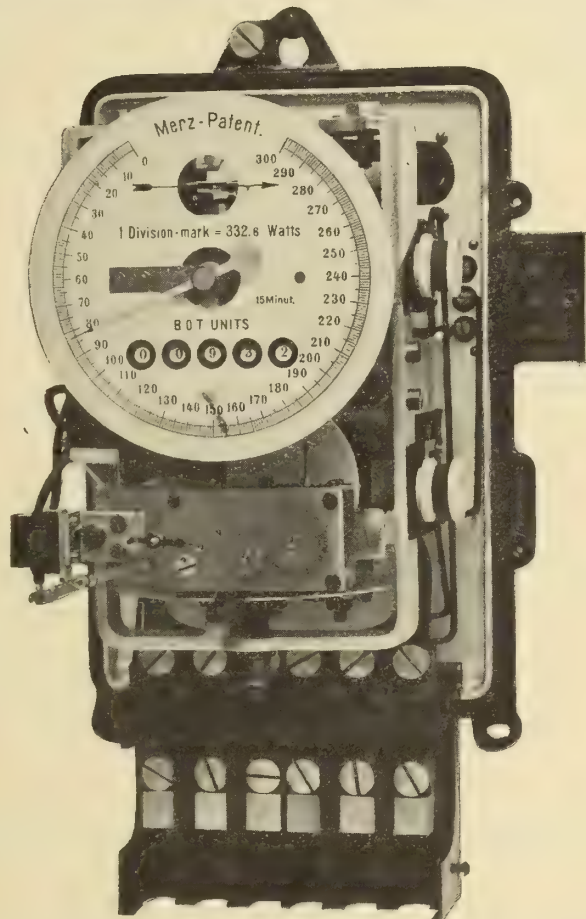
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## What the Meter Does

1. Gives the kilowatt hours.
2. The highest load demanded in watts on a time average of say 15, 30 or 60 minutes.

The accurate measurement of these two quantities enables a true load factor system of charging to be adopted.



## What can be Done With the Meter

1. Charge an annual sum per K. W. or Horse power year to cover capital and standing costs.
2. Charge a low straight rate per K. W. hour based on running costs and profit required.

## These Meters are Approved by the Board of Inland Revenue

Siemens combined integrating and maximum demand meters.

We have in STOCK three phase meters suitable for 110 volts and 550 volts for 25 and 60 cycle circuits, also meters for use with instrument transformers for large capacities.

# Siemens Company of Canada Limited

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TORONTOMcARTHUR BUILDING  
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# Current News and Notes

## Bury, P. Q.

The power line of the Westbury Electric Light & Power Company has been completed from their power house near East Angus to the village of Bury, which is now supplied with electric light and power.

## Calgary, Alta.

The Powell River Company, Limited, has been registered under the Ordinance of the North Western Territories respecting Foreign Companies.

The Canada West Electric Company, Limited, has been registered under the Ordinance of the North Western Territories respecting Foreign Companies.

The Weno Power & Light Company will make application at the next session of the Alberta legislature for power to construct the necessary transmission lines for the transmission of electric energy along and upon certain road allowances in a number of townships named.

## Chatham, Ont.

On October 12th a by-law will be submitted in Chatham, authorizing the expenditure of \$90,000 in the erection of a hydro-electric sub-station and distributing system.

A by-law authorizing the expenditure of \$90,000 on a sub-station and distributing equipment will be voted on October 12th.

## Cornwall, Ont.

A by-law will be submitted October 14th, authorizing the Council to grant a twenty-year franchise to the Cornwall Street Railway, Light & Power Company.

## Hamilton, Ont.

The fire which recently occurred at the plant of the Canadian Tungsten Lamp Company, Cannon Street, Hamilton, only did a very inconsiderable damage and did not interfere in any way with the work.

## Kingston, Ont.

The Kingston Utilities Commission are again negotiating with Mr. J. M. Campbell for the supply, in bulk, of 500 h.p. of electric energy; this to be generated by Mr. Campbell at Kingston Mills.

Kingston's new White Way, consisting of 96 6.6-ampere magnetite arc lamps, has been in operation some three weeks. The citizens are highly pleased with the new installation.

## Lachine, P.Q.

This town has awarded the contract for a motor-driven turbine pump to E. Laurie & Company, Montreal.

## Montreal, Que.

A contract has been awarded to the Beaver Electric Company, Montreal, for the electrical work required in connection with alterations to the factory of J. C. Wilson, Ltd.

A particularly smart piece of work in the way of installing electrical machinery and erecting poles, etc., has just been carried out at Sheds No. 24 and 25 on the Montreal Harbour. The Government decided to fit up these sheds for baling compressed hay for the cavalry which are going to the front, and to obtain the necessary electrical power, a new line had to be constructed and machinery installed. By working day and night the poles were put up, the buildings wired, and the machines installed in a very short time. Sixteen very heavy compressing machines are now in operation.

These are electrically driven, the current being supplied by the Montreal Light, Heat and Power Company over a special line. It is transformed from 2200 volts to 550 volts, three 75 kw. transformers being used. The Government purchased four 100 h.p. Canadian General Electric motors, each motor driving four compressing machines. The small sub-station in which the transformers are located was partially built, and the remainder of the work was done under great pressure. Much of the work is naturally of a temporary character to meet the present emergency, but later it is intended to make it permanent in order to take care of the shipping in the sheds and of lighting a portion of the harbour.

Dr. L. A. Herdt, of McGill, and chairman of the Montreal Electrical Commission, has left for Europe, on private business. He will be away for several weeks.

The Canadian Light and Power Company, Montreal, have just about completed the fourth installation at St. Timothee, P.Q., and expect to have this in running order the first or second week in October.

The Montreal Electrical Commission have made arrangements to continue work on the conduits, the contracts for which are all held by Mr. G. M. Gest. The Montreal Public Service Corporation commenced the work of pulling down their poles on St. Catherine St.—the first thoroughfare on which conduits were laid—on August 24 and are proceeding with the work, in order that connections for lighting and power purposes may be made as soon as possible. The same company are also taking down their poles on Bleury street. The poles were originally installed by the Saraguay Electric and Water Company, the Dominion Light and Power Company, and the Montreal Electric Light Company.

The marriage of Mr. C. P. Waterous, superintendent of the Waterous Engine Works Company, St. Paul, Minn., with Miss Fanny Nagle, daughter of Mrs. F. A. Nagle, 61 Chesterfield Avenue, Westmount, was celebrated in that city on September 16. Mr. Waterous is the grandson of the founder of the well-known Waterous Engine Works Company, Limited, Brantford, Ont., of which the St. Paul plant is a branch.

Montreal electrical interests have been large contributors to the Canadian National Patriotic Fund. A special campaign was undertaken by all classes, with the result that in five days the sum of about \$1,500,000 was raised. Mr. H. S. Holt, president of the Montreal Light, Heat and Power Company, strenuously supported the campaign, and presided at one of the luncheons organized to boost the fund. The following are among the large contributions: Bell Telephone Company, \$20,000; employees of the same company, \$12,800; Montreal Light, Heat and Power Company, \$10,000; Mr. H. S. Holt, \$10,000; Shawinigan Water and Power Company, \$10,000; Montreal Tramways Company, \$10,000; employees of the Montreal Tramways Company, \$8,000; Northern Electric Company, \$5,000; employees of Montreal Light, Heat and Power Company, \$3,500; J. E. Aldred, president of the Shawinigan Water and Power Company, \$1,000; Alex. Pringle and R. E. T. Pringle, \$500; employees of the Montreal Public Service Corporation and Canadian Light and Power Company, \$555. Mr. H. S. Holt states that the donation of the Shawinigan Company was given on the motion of two United States citizens at the meeting of the directors. Mr. Holt also states that on the same initiative the directors have agreed to make a further subscription should it be needed.



# UNDERGROUND CABLES

## LOW AND HIGH TENSION

FOR LIGHTING,  
POWER,  
STREET-  
RAILWAYS,  
TELEPHONE,  
TELEGRAPH.



ARMoured  
CABLES FOR  
STREET  
LIGHTING,  
PAPER  
INSULATED  
CABLES OF ALL  
DESCRIPTIONS,  
RUBBER INSULA-  
TED CABLES &c.

Also Bare and Weatherproof Wires and Cables,  
Magnet Wire, Flexible Cords, &c.

### Galvanized Iron Wire and Strand

HEAD OFFICE:

## MONTREAL, CANADA

BRANCHES:

Toronto,

Winnipeg,

Halifax,

Vancouver.



**New Denver, B.C.**

The town is again supplied with electric light after being in darkness for a month following the destruction, by fire, of the power plant of the New Denver Light & Power Company.

**New Toronto, Ont.**

At a recent meeting of the New Toronto Council, the contract in connection with the municipal water filter system was awarded to the Canadian Allis-Chalmers Company for pumps and motors. The capacity of this plant will be 1,000,000 gallons per day.

**Raymore, Sask.**

Raymore Village Telephone Company, Limited, has been incorporated.

**Regina, Sask.**

The operation returns of the Regina Municipal Railway System for the week ending September 5th were as follows: Revenue, \$3,322.60; passengers carried, 74,531; the corresponding figures for the week ending September 12th were \$2,998.10 and 73,008.

**Sherbrooke, Que.**

The annual statement of the Sherbrooke Railway and Power Company for the year ending June 30th, 1914, shows a gain of \$15,344 or 12.13 per cent., in gross earnings. Operating expenses have been higher, however, so that only some \$2,000 profits net remain after bond and other interest obligations have been discharged. The president of the company, Mr. C. J. McCuaig, states that the prospects for increased earnings in 1915 are quite favorable, though these must necessarily be affected to some extent by the European war. Several manufacturers during the past couple of months have reduced their power requirements, but, as the company has contracted for the greater part of the

power available from its present development, the earnings should show a satisfactory increase as soon as normal trade conditions again prevail.

**Shoal Lake, Man.**

Tenders are called for the sale of \$11,000 5 per cent. twenty-year electric debentures of the village of Shoal Lake.

**St. Thomas, Ont.**

James S. Bell, city treasurer, and F. G. Jewell, city auditor of St. Thomas, have been named respectively treasurer and auditor of the London and Port Stanley Railway Commission, created for the purpose of carrying through the electrification of the London and Port Stanley line.

**St. John, N.B.**

The name of the New Brunswick Hydro-Electric Company has been changed to the New Brunswick Power Co.

**Toronto, Ont.**

The Toronto Hydro-Electric Commission will ask special permission to borrow \$2,000,000 for necessary extension work, to be carried on during the coming autumn and winter.

**Valcartier, P.Q.**

The hurry-up order for light and power equipment and supply recently placed with the Quebec Railway, Light, Heat & Power Company has resulted in the immediate supply of a sufficient capacity to operate approximately five hundred 100-watt lamps and a 75 h.p. motor. The company is to be congratulated on the expeditious manner in which the work was carried out.

**Vancouver, B.C.**

Macdonald, Marpole Company, agents for the Canada Wire & Cable Company, have received an order for a large quantity of two pair twisted wire for the city of Revelstoke, B.C.

# Canada Wire & Cable Co., Limited, Head Office and Works TORONTO

## Bare and Insulated Electrical Wires for all purposes Electric Railway Trolley Wire and Feeder Cable

*Sales Offices and Branch Warehouses:*

401 Lake of the Woods Bldg., MONTREAL

150 Princess Street, WINNIPEG

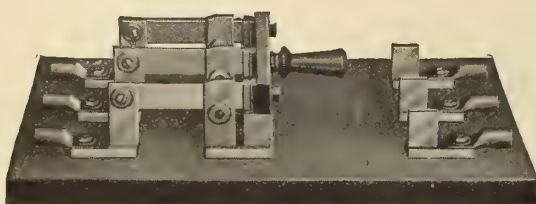
Macdonald Marpole Company, Limited, 427 Seymour Street, VANCOUVER

*Prompt shipments from Factory or nearest warehouse.*



# KNIFE SWITCHES

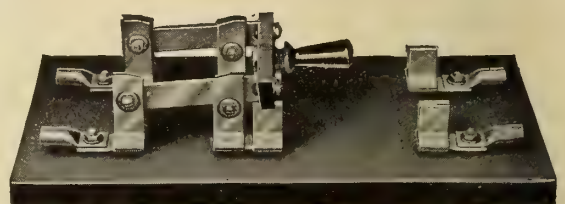
30 to 5000 AMPERE



Type "A" See catalog, pages 6 to 11.

Front Connected  
Back Connected  
Motor  
Starting  
Switches

Write for  
catalog No. 21



Type "F" See catalog, pages 16 to 21

**FRANK ADAM ELECTRIC COMPANY**

**ST. LOUIS, Missouri, U. S. A.**





Model 280, Single Range  
Portable Voltmeter.  
(One-quarter size.)



Model 267, Switchboard  
Ammeter.  
(One-quarter size.)

They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity. They are substantially constructed and may be safely sent long distances through the mails and will withstand an extraordinary amount of vibration without injury. They have the longest scale ever provided in instruments with equal length of pointer. Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year. The portable instruments may be conveniently carried in the coat pocket. The prices have been established upon so low a scale that any one may possess one or more of these remarkable instruments at moderate cost.

If you cannot obtain the instrument desired from your dealer, write us.

The several models and ranges offer a selection from over 300 different combinations, listed in Bulletin No. 8. Will be mailed upon request.

## WESTON ELECTRICAL INSTRUMENT COMPANY, Main Office and Works, NEWARK, N.J.

Mr. Stanley Brown, 114 Liberty  
St., New York City.  
Badt-Westburg Elec. Co., 832  
Monadnock Block, Chicago, Ill.  
Mr. F. E. Gilbert, 303-4 Hale  
Bldg., 1326 Chestnut St., Phila-  
delphia, Pa.  
Mr. Geo. H. Moseman, 176 Feder-  
al St., Boston, Mass.

Mr. Milton Mill, 915 Olive St.,  
St. Louis, Mo.  
B. K. Sweeney Electrical Co.,  
2910 Huron St., Denver, Colo.  
Mr. Frank E. Smith, 682 Mis-  
sion St., San Francisco, Cal.  
Mr. S. C. Dinsmore, 1933 Dime  
Bank Bldg., Detroit, Mich.  
Walter P. Ambos Company, 1729

East 12th St., Cleveland, Ohio.  
A. H. Winter Joyner, Ltd., No.  
76 Bay St., Toronto, Canada.  
Weston Instrument Co., Ltd.,  
Geneststrasse 5, Schoneberg, Ber-  
lin, Germany.  
Mr. D. R. Petest, 415 Fourth  
Nat'l. Bank Bldg., Atlanta, Ga.  
Mr. Edwin Wortham, Suite 28

Allison Building, 8th St. and Main  
St., Richmond, Va.  
Montreal }  
Winnipeg }  
Vancouver } *Northern Electric Company*  
Calgary }  
Weston Electrical Instrument  
Co., Audrey House, Ely Place,  
Holborn, London, E.C.

# WESTON

## Miniature Precision Instruments for Direct Current

A new group of very small Indicating Instruments.  
**COMPACT—ACCURATE—DURABLE—BEAUTIFUL**

### PORTABLE

Voltmeters, Millivoltmeters, Volt-Ammeters, Ammeters, Mil-Ammeters are supplied  
in single, double and triple ranges.  
The Volt-Ammeter comprising six instruments in one.  
This group also includes BATTERY TESTERS.

### SWITCHBOARD

Voltmeters Volt-Ammeters Ammeters Mil-Ammeters  
This new line of instruments represents the latest development of the pivoted  
moving coil, permanent magnet type for low ranges.  
The refinement of design and mechanical work in them has been carried to a  
degree which would appear to be almost impossible of accomplishment, if the results  
were not evident in the instruments themselves.

They embody characteristics which have made the well known Weston  
Standards famous throughout the world.

They are accurate, dead beat and extremely sensitive.

They may be left continuously in circuit at full load without injury and are shielded against the external  
electrical and magnetic influences of other apparatus in their vicinity.  
They are substantially constructed and may be safely sent long distances through the mails and will withstand  
an extraordinary amount of vibration without injury.

They have the longest scale ever provided in instruments with equal length of pointer.  
Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year.  
The portable instruments may be conveniently carried in the coat pocket.  
The prices have been established upon so low a scale that any one may possess one or more of these remarkable instruments at moderate  
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Mr. D. R. Petest, 415 Fourth  
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Mr. Edwin Wortham, Suite 28

Allison Building, 8th St. and Main  
St., Richmond, Va.  
Montreal }  
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Co., Audrey House, Ely Place,  
Holborn, London, E.C.

# Power Cables

Manufactured by

**British Insulated & Helsby Cables, Limited**

**PAID-UP CAPITAL, \$8,500,000.00**

**HEAD OFFICE—PRESCOT, ENG. Works at PRESCOT, HELSBY and LIVERPOOL**

Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and  
double steel tape armored cable for a working pressure of 660 volts. This cable is for  
laying direct in the ground without any protection whatever and is similar to that supplied  
to the cities of Saskatoon, Prince Albert, etc., etc.

**WRITE FOR ILLUSTRATED CATALOGUE**

**SOLE CANADIAN REPRESENTATIVES :**

**Canadian British Insulated Co.**

**MONTREAL, QUE.**

**LIMITED**





# Condensed Department

## Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure in section in the subsequent issue.

## WANTED

A manufacturer of a widely known line of Electrical goods desires representation in Winnipeg and Calgary. Communicate at once with H. M., Hotel Sherman, Chicago, Ill. 19

**P**ROCURED IN ALL  
COUNTRIES  
LONG EXPERIENCE  
IN PATENT LITIGATION

SEND FOR HAND BOOK

**PATENTS** PHONE  
MAIN  
2582

**RIDOUT & MAYBEE**

59 Yonge Street

TORONTO, - - - CANADA



## SECOND HAND ELECTRICAL MACHINERY

Bought, sold, rented, and exchanged.  
We have the largest stock in America.  
Send for our monthly bargain sheet  
showing complete stock with our prices.



## EMPLOYMENT WANTED

Electrical Switchboard Operator, married, desires change. Experienced in A.C. and D.C. work. Present position hydro plant, two years. References. Box 67, Electrical News, Toronto. 18-19

MacLean Reports will put you in touch with the right job at the right time, the right man to see and the right place to find him. It will pay you to use them in your business. Rates and samples on application.

**MacLean Daily Reports**  
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Motors, Dynamos, Generators,  
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52 Queen Street - OTTAWA

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# FIRST

## FOR CONDUIT

# Xceladuct - Orpenite

Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by COPPER-PLATING and zinc coating.

Clean threads and smooth enamelled interior allows rapid fishing.

Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

Let us submit prices and particulars.

## Orpen Conduit Company, Limited

TORONTO, ONT.

MONTREAL, QUE.



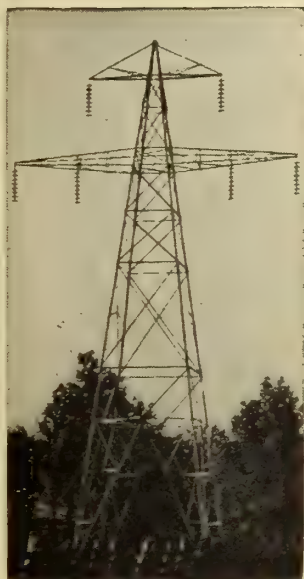
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**B. A. PERRY***Illuminating Engineer**Designer of Lighting Fixtures**Lighting Plans Laid Out and Specifications Supplied*

TORONTO

ONTARIO

**TRANSMISSION TOWERS**

Hot Galvanized or Painted

Estimates furnished on  
application**The Canadian  
Bridge Co.**

Limited

Walkerville, Ontario, Canada

MANUFACTURERS OF

**DOUBLE CIRCUIT TOWER**

One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario. Transmitting a 110,000 volt current from NIAGARA FALLS to the principal cities of ONTARIO. The largest single order of Transmission Towers ever placed.

**STEEL RAILWAY AND  
HIGHWAY BRIDGES****Structural Steel of all kinds****British Columbia Cedar Poles**

Open Tank Treated With

**AVENARIOUS CARBOLINEUM**

will double or treble the ordinary life of your line at a small cost. It will pay you to investigate. Ask for full information and our special folder.

**The Lindsley Brothers Company**

"Good Poles Quick"

Spokane

Washington

**MOONSTONE  
LIGHTING  
GLASSWARE**

St. Anne's Church, Toronto  
Architect—Arthur W. Holmes

The soft, luxurious light produced by Moonstone glass shows beautiful surroundings to the best advantage.

There is a Moonstone design for every service.

**Jefferson-Glass Co., Limited**

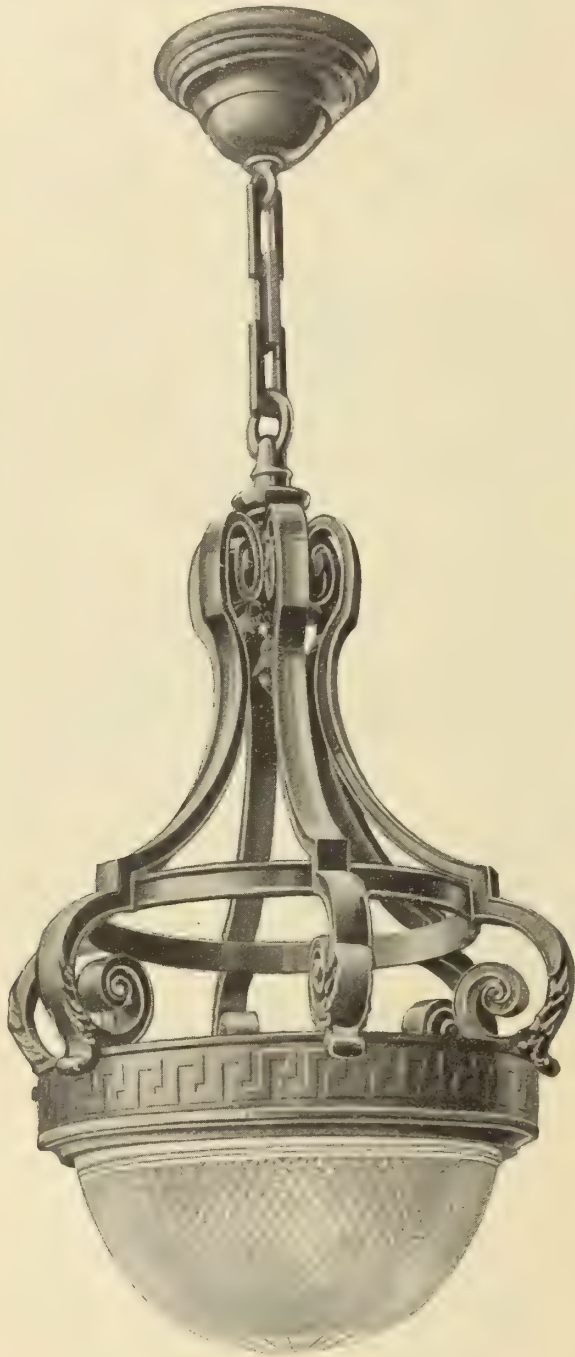
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## Tallman Electric Fixtures

*They're different*



We make an exclusive line of Fixtures for House, Bank, Church and Office Lighting.

*Our Designs are Original.*

We shall be pleased to submit special designs on application.

MANUFACTURED BY THE

**Tallman Brass & Metal Co.**  
**HAMILTON, ONT.**

## Use the Railway's Trolley Poles

as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of



### ERECO Combination Railway Lighting Pole Fixtures

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

Design No. 10015

**Electric Railway Equipment Co.**  
 Cincinnati, Ohio

Designers

Manufacturers

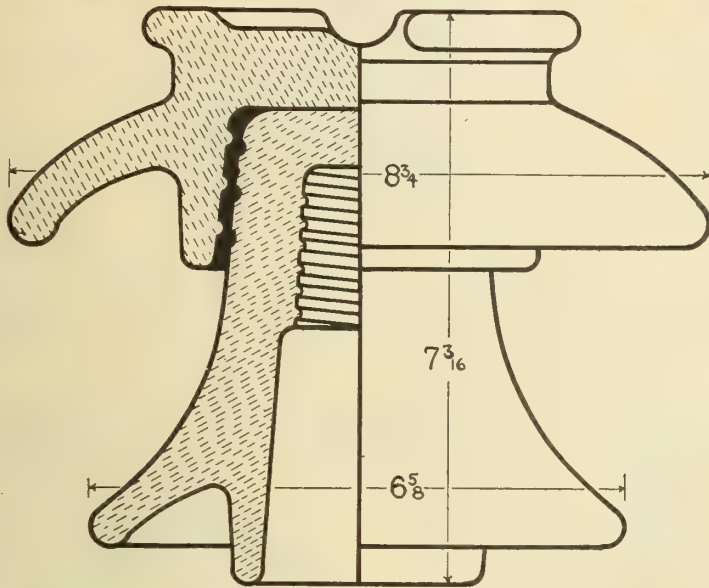
Canadian Representatives:

Dawson & Co., Limited, Montreal, Winnipeg

N. Y. Office, 30 Church St., Hudson Terminal Bldg.



# CANADIAN INSULATORS



Number	133
Line voltage	30,000
Test voltage	100,000
Rain test	65,000
Leakage distance	17 3/4-in.
Pin hole	13/8-in.
Net weight	10 1/2-lbs.
Packed weight	12-lbs.
No. per crate	6

**The Canadian Porcelain Company, Limited**  
HAMILTON, - CANADA



## EVERYBODY IS DOING IT!

"THE METROPOLITAN WAY"

THE EQUITABLE LIFE BUILDING

"The Largest Office Building in the World" is to have a Switchboard built to order by

**The Metropolitan Electric Manufacturing Co.**

Long Island City

Just over the Bridge at 59th Street, New York City

Specialists in

**SWITCHBOARDS, PANELS and ELECTRICAL DEVICES**

CANADIAN AGENTS:

**ECONOMY ELECTRIC CO.**

Bank of Hamilton Building

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## Everything Electrical Repaired NO JOB TOO LARGE

We specialize in the repair of all kinds of electrical instruments and machinery. Our large staff of experts enables us to give you prompt and efficient service.

Get our prices on the re-winding of motors and generators, over-hauling of switch boards, re-construction of power plants, etc.

One trial will convince you.

## KANALY ELECTRIC COMPANY

Phone Garry 4359  
56 Princess Street - WINNIPEG

## PHANTOM LOADS

Portable and Laboratory Loads

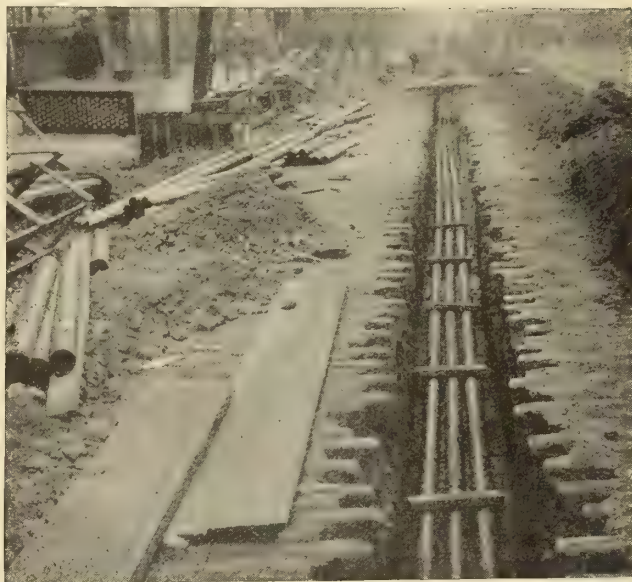


The best that can be made.

Type B shown in cut.

Send for bulletin 19

**THE STATES CO.,** 15 New Park Ave.,  
HARTFORD, CONN.



Manitoba Government Installation at Winnipeg.

7 foot Lengths.  $\frac{3}{8}$ -in. walls.  $\frac{5}{8}$ -in. joints. Absorption, 100 Hrs.,  $\frac{1}{4}$  of 1%  
Puncture Test 50,000 V. Electrolysis-proof—Water-proof—Gas-proof.

Comparison of above figures with other types of Fiber Conduit will show the superiority of our product.

## American Conduit Co.

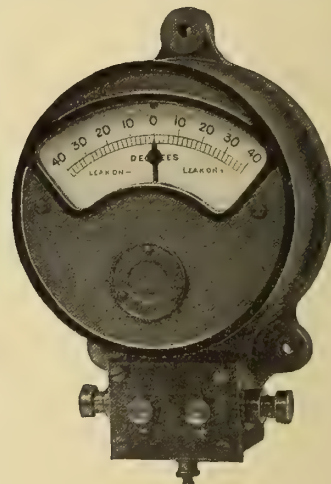
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LIMITED

Montreal, Halifax, Toronto, Winnipeg, Regina,  
Calgary, Edmonton, Vancouver, Victoria

## Evershed & Vignoles, Limited



## Indicating Leakage Recorder Switchboard Type

Provides accurate means of determining in an instant the absolute value of the insulation resistance of each main.

Write for catalogue to

**R. H. NICHOLS**  
Agents, Dineen Building, TORONTO

## M I C A

Canadian Amber

Indian Ruby

## For Every Purpose

Cut or uncut, stamped to pattern. Selected to cut any size or in regular grades. Splittings, Washers, Gramophone Discs. I also carry the largest stock of Stove Mica in Canada.

Write for prices and samples.

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Miner, Importer and Wholesale Dealer

86-88 Duke St. - OTTAWA, Canada

BRANCHES—34 West 33rd St., New York Kodarma, Bengal, India



Why not sell more day current?

## Simplex Electric Household Ranges

make a strong appeal to the housewife for summer use. There must be many homes in your territory in which a Simplex Range could be sold, if its advantages were known. There is a size for every purpose, from the smallest kitchenette to the largest country house. You do yourself a good turn every time you recommend and sell a Simplex Range. It blazes the path for other Simplex goods and larger use of day current.

## SIMPLEX ELECTRIC HEATING CO.

Mfrs. of Everything for Electric Heating and Cooking  
BELLEVILLE, ONT.

CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.  
SAN FRANCISCO, 612 Howard St.

Member of THE RICE LEADERS OF THE WORLD ASSOCIATION



# X ARMS

Do You Appreciate what

*Superior*

means when applied to X Arms, Locust Pins, or Pole Line Hardware?

It means in Locust Pins, Braces, Bolts, Washers, Pole Steps, Etc., all meet A.T. & T. specifications, and in Arms: Washington Fir—at least 85 per cent. heart.

Spruce—Kyanized,

Georgia Pine—Long Leaf—at least 75 per cent. heart.

All guaranteed. We stock nothing regularly of a quality inferior to the above.

## STUART - HOWLAND CO.

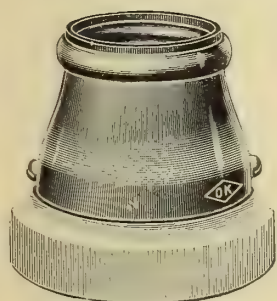
131 to 141 Federal St.,

BOSTON

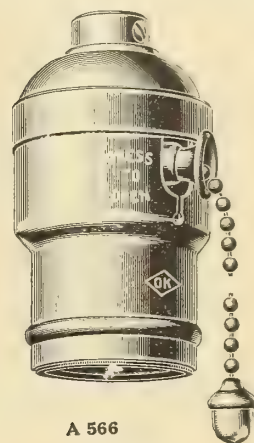
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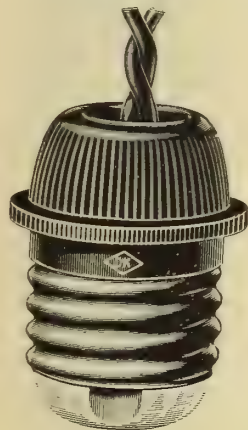
Order through your jobber



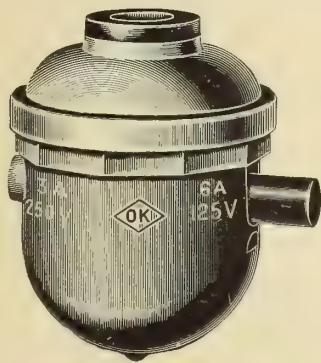
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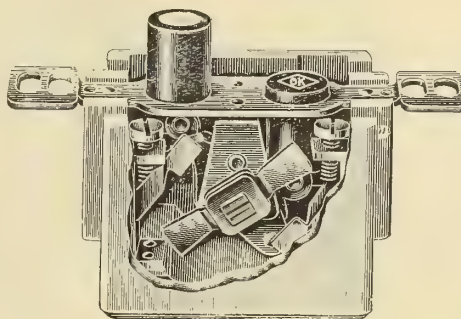
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### Sterling Telephone & Electric Co., Ltd. London, England

## We Have a Bell For Every Purpose

There can be only one best and that is the Schwarze. No. 12 Common Magneto Extension for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire is all active. Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and very much louder, and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof.

Write for catalogue.

All resistances.



### Schwarze Electric Co., Adrian, Michigan

Norton Telephone Co., Canadian Agents



# Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

*Prompt Shipments from Canadian Factory.*

**BOSTON INSULATED WIRE & CABLE COMPANY**

Canadian Office and Factory, HAMILTON, ONT.

## "UNILETS"

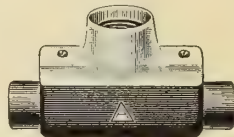
are drawn from steel and possess many merits which are an absolute necessity for up-to-date conduit work. For durability, neatness, space for making wire connections, "Unilets" meet all requirements. "UNILETS" are mechanically right. The conduit is steel, why not the fitting? Try them on your next job. A copy of our new catalogue should be before you. You cannot afford to be without it. Write us at once for your copy.



Cat. No. 9001—Rectangular Unilet.



Cat. No. 9002—Rectangular Unilet.



Type No. 2—Rectangular Unilet. Cat. No. 9002 with No. 7650 Receptacle.



Type No. 1 Octagon Unilet. Cat. No. 7501.



Type No. 4—Round Unilet with enclosed Snap Switch.



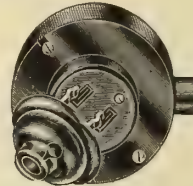
Cat. No. 7322—Shade Holder



Cat. No. 6906 Vapor-Proof Unilet.



Combination Plug Receptacle and Push Button Switch Unilet—Hubbell Plug Receptacle and Arrow E Push Button Switch Attached.



Type No. 1—4-inch Round Unilet with Two-phase Receptacle Attached.



Type No. 2—Switch Unilet. Cat. No. 6501. with Push Button Switch Attached.

ADDRESS DEPT. "D" FOR COPY OF CATALOGUE No. 7

Also send for a copy of our small booklet on "Unilets".

**APPLETON ELECTRIC COMPANY**

Main Office and Factory CHICAGO 212-214 N. Jefferson Street

For Sale in Canada by

The Mainer Electric Co., Ltd., Winnipeg

Marshall-Wells Co., Ltd., Winnipeg

Chapman & Walker Ltd., Toronto

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TAPS CUTTERS  
DIES REAMERS  
HOBS DRILLS

Large Stock—Prompt Delivery

*Our Guarantee—Satisfaction or your money back.*

**Pratt & Whitney Co., of Canada, Limited**  
DUNDAS, ONTARIO

Montreal Winnipeg Vancouver

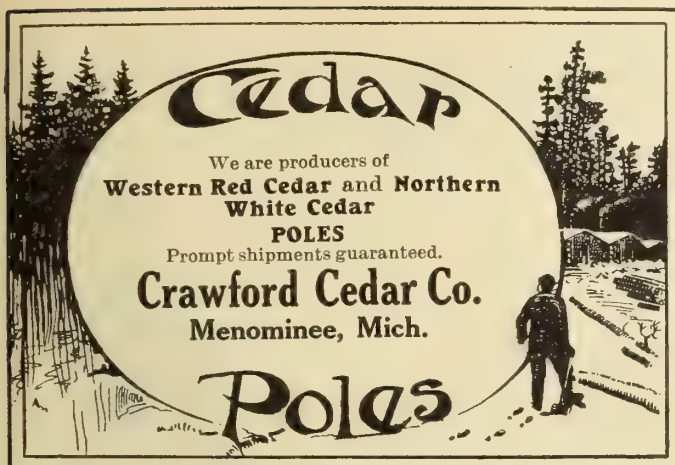
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ELECTRICAL CONDUCTORS

Ingot Sheet Wire Rod Tubing

**Northern Aluminum Co. Limited**  
1305-6 Traders Bank Bldg.  
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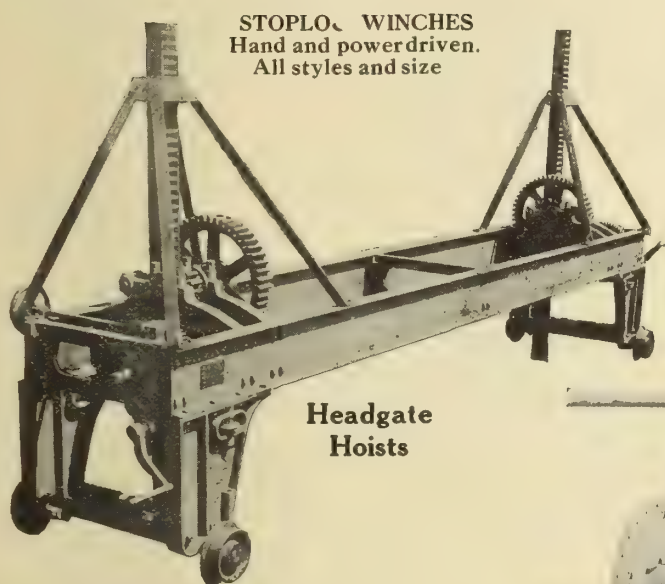
**Cedar**

We are producers of  
Western Red Cedar and Northern  
White Cedar  
**POLES**  
Prompt shipments guaranteed.  
**Crawford Cedar Co.**  
Menominee, Mich.

**Poles**

IN TIMES OF STRESS  
Use  
**I-T-E Circuit Breakers**

**THE CUTTER CO.**  
PHILADELPHIA

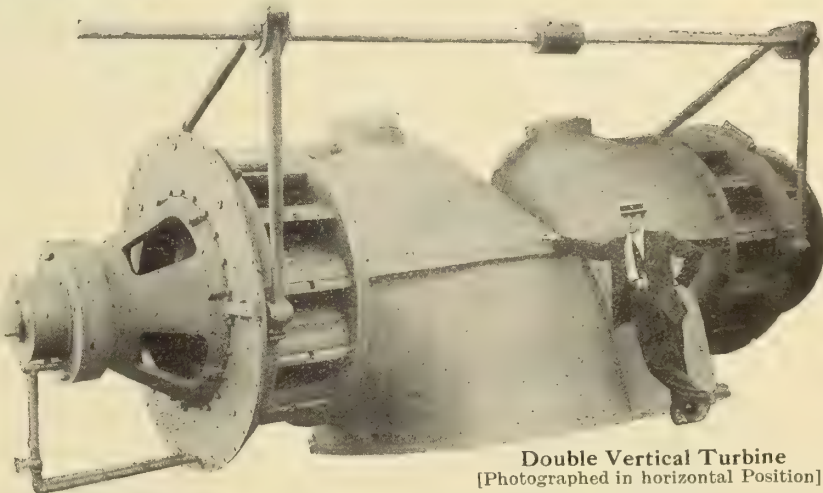


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Hand and power driven.  
All styles and size

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Plant Machinery**  
**Steel Castings**  
**Propeller Wheels**

**Machine Cut Gears**  
**Extra large stock patterns for**  
**Heavy Bevel Gears**  
having wood and iron teeth.  
**Heavy Pulleys and**  
**Bearings, etc.**



**Double Vertical Turbine**  
[Photographed in horizontal Position]

**THE WM. KENNEDY & SONS, LTD., Owen Sound, Ont.**



**7 CEDAR POLE YARDS IN B. C.—7**

For prices on B. C. Cedar Poles address

**WESTERN LUMBER & POLE COMPANY**  
Main Office - DENVER, COLO.

**NAUGLE**

**Pole & Tie Co.**

Main Office  
5 South Wabash Ave  
Chicago, Illinois

We have yards in  
Canada guarantee-  
ing our motto:  
"SERVICE"  
"PRICE" "QUALITY"  
ONE QUALITY  
ANY QUANTITY

**POLES**



Electrical  
Mechanical

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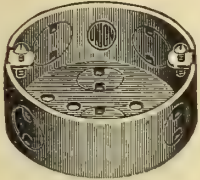
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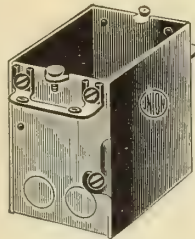


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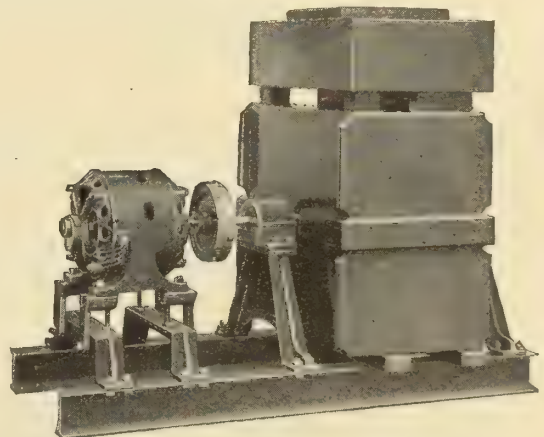
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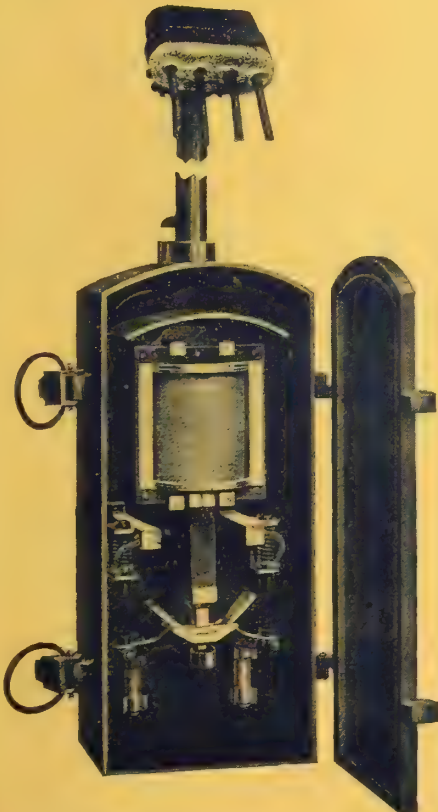
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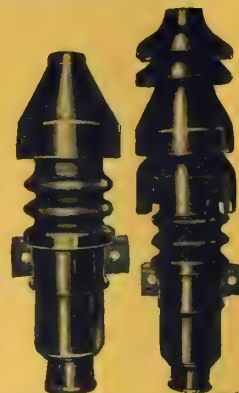
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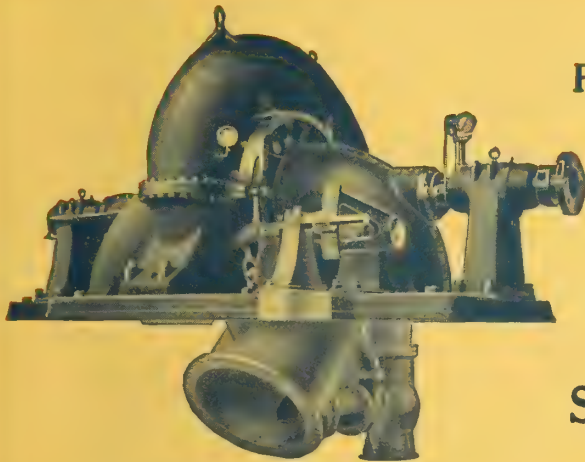
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Generation, Transmission and Application of Electricity



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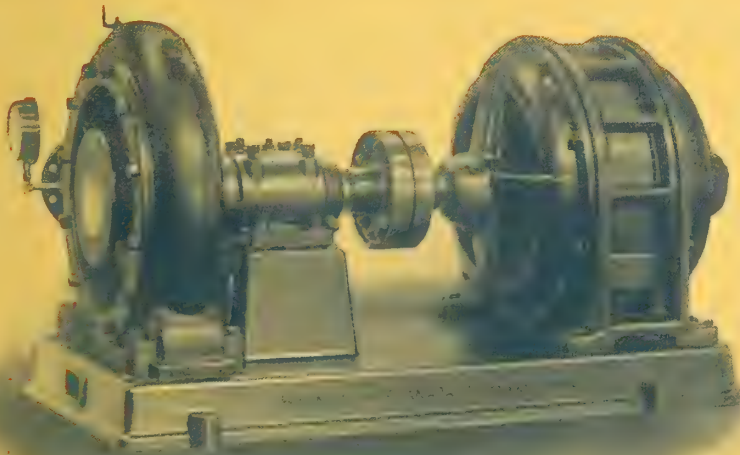
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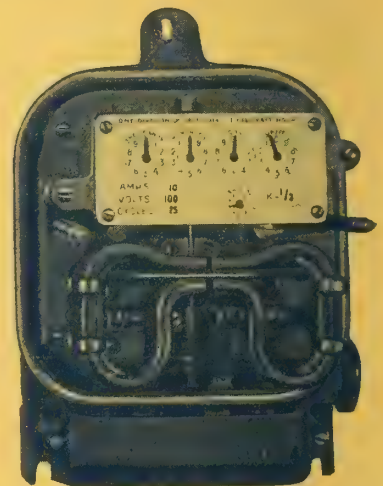
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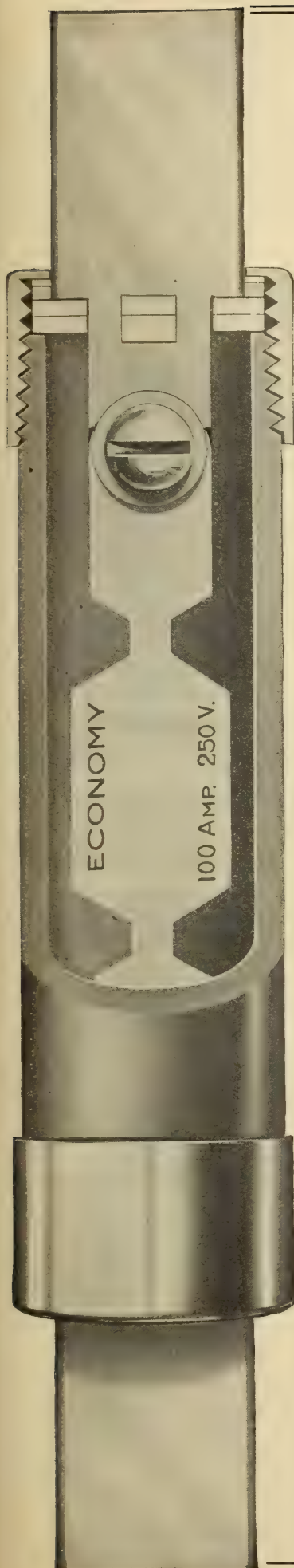
The entire volume of the fibre shell is unoccupied except by the Economy “Drop-Out” Renewal Link. The liberal air space thus provided permits a rapid gas expansion, but with low resultant pressure due to the small amount of metal in the “Drop-Out” Link which is volatilized by operation. No end-holes allow direct venting of fire, as the gases liberated are restrained by the resilient and metal end-washers which entirely close that portion of the fuse, permitting the gases to escape only by the path provided by the clearance of the threads under the brass cap. In addition, the centering washer system aligns and centers the blade members and allows flexibility sufficient for the adjustment of the blades to the clips into which the fuse is inserted and therefore to give good, uniform contacts on both sides of the blades.

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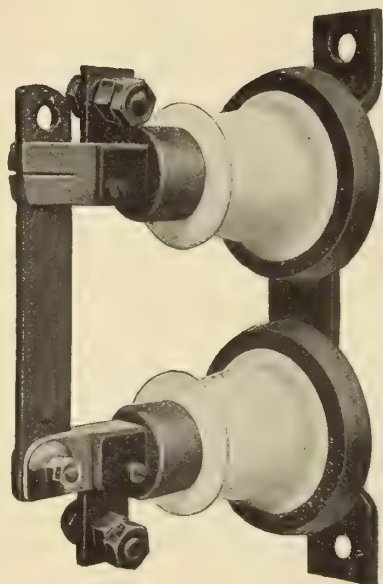
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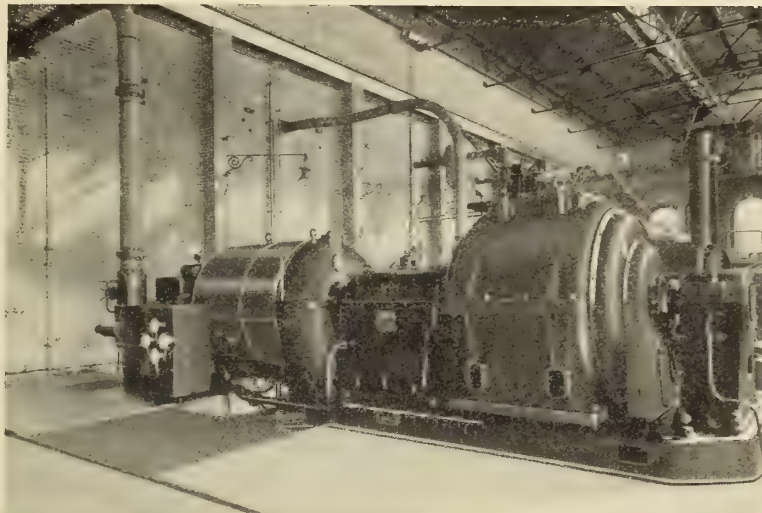
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**The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers**



**G  
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Fort Garry Hotel Winnipeg. A "GALVADUCT" Building  
Ross & Macdonald, Architects

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**"GALVADUCT"**

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify "Galvaduct" or  
"Loricated" Conduits

**"LORICATED"**

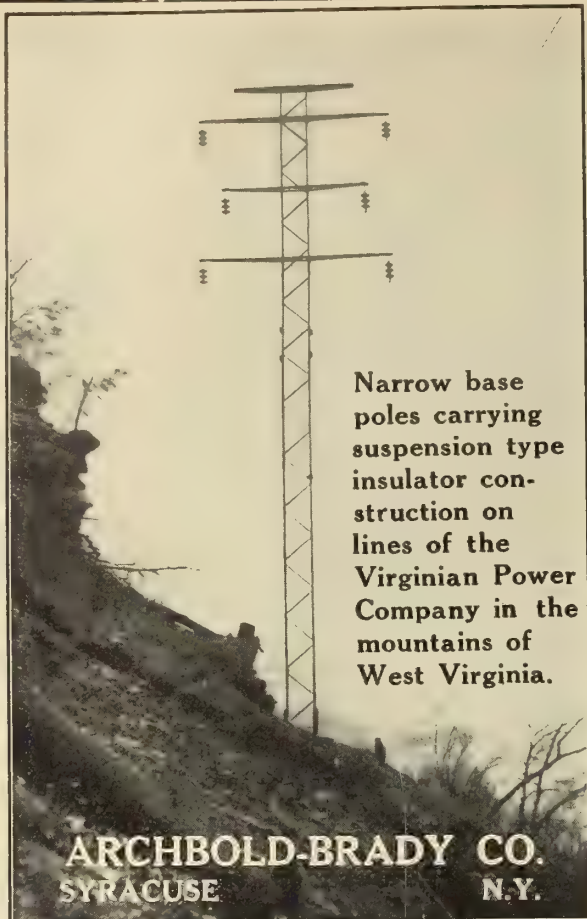
A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply  
you—write us

**Conduits Company Limited.**

**Toronto - Montreal**





Narrow base poles carrying suspension type insulator construction on lines of the Virginian Power Company in the mountains of West Virginia.

**ARCHBOLD-BRADY CO.**  
SYRACUSE N.Y.

## BASTIAN HEATERS

(ENGLISH PATENTS)



The Electric Heater that HEATS.

### NEW FALL FEATURES:

- 1.—Rodolite Glowers—increased capacity.
- 2.—Mantel Type Bastians for fireplaces.
- 3.—Flush Type Bastians for recesses.

Be ready NOW to DEMONSTRATE BASTIAN HEATERS.  
They Sell Fast.

## THE MASCO COMPANY

Distributors

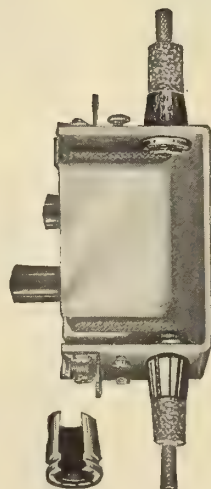
LIMITED

58-60 Church St., Toronto

"Jobbers of Standard Electrical Goods"

# UNIVERSAL BUSHINGS

## FOR FLEXIBLE TUBING



No. 1&3 Universal Bushings  
Patented

Meet and overcome the many difficulties in holding flexible tubing securely in switch boxes, cabinets, outlet boxes and junction boxes.

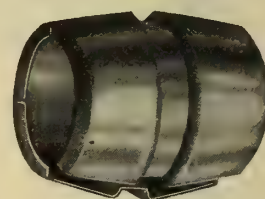
They are one-piece bushings, easily and quickly installed without the use of tools, and can be removed for inspection and replaced without injuring bushing or tubing. THEY SAVE TIME AND TROUBLE.

UNIVERSAL BUSHINGS are made in four sizes which cover every condition in wiring.

Nos. 1 & 3 for  $\frac{5}{8}$ -in. knockouts;  $\frac{1}{4}$ -in. and  $\frac{7}{32}$ -in. tubing.  
Nos. 2 & 4 for  $\frac{7}{8}$ -in. knockouts;  $\frac{1}{4}$ -in. and  $\frac{7}{32}$ -in. tubing.

We also manufacture FLEXIBLE TUBING CLAMPS for holding tubing at wall and ceiling outlets where boxes are not used. TRY THEM.

Approved by National Board of Fire Underwriters



No. 2 & 4 Universal Bushings  
Patented

Write for prices and samples of these "Money Savers"

# New Process Specialty Company, Inc.

MILWAUKEE,

--

WISCONSIN





## Profitable Instruments

### For the Dealer

Here's a line of Interior Telephones and Electric Reset Annunciators that give great satisfaction to users. We have specialized in this class of work for twenty years and can offer dealers an exceptionally good proposition.

**CONNECTIGUT**

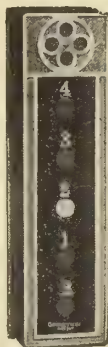
## Electric Reset Annunciators

stand for superior quality and reasonable price. They are made to give lasting service and do not get out of order. They have many advantages not possessed by other makes.

*Write for catalog 22C and special agency proposition.*

*Handle this line in your city*

**Connecticut Telephone & Electric Company, Inc.**  
Meriden, Conn., U. S. A.



### This New Bulletin

describes the uses and advantages of steel-tape-armored cable. It also gives specifications instructions for ordering and installing

### STANDARD Steel-Tape-Armored Cable

If you desire this or any of the following new bulletins write our nearest office for a copy:

- No. 200—1 Colonial Copper Clad Specifications
- No. 400—1 Weatherproof Wire
- No. 680—1 Steel Tape Armored Cable
- No. 700—1 D.O.A. (Davis Open Air) Terminals
- No. 710—1 D.S. (Davis Station) Terminals

**Standard Underground Cable Company of Canada, Limited**

Hamilton, Ont.

Montreal, Que. Winnipeg, Man. Seattle, Wash.

## Electrical Decorations For Rent

**WE** make a specialty of High-Class Decorations for Street Fairs, Carnivals, Celebrations, Centennials, Old Home Weeks, Street Conventions, Conclaves, Parks, Buildings, Auto Shows, Balls, Fairs, Dances, Banquets, Industrial Expositions, Food Shows, Christmas and New Years, etc.

Our decorations are elaborate, appropriate and refined. We carry a complete line of Electrical Set Pieces, Signs, Streamers of Lights and Bunting for all Lodges, Orders and all occasions. Get our prices and designs.

**Contractors and Dealers are requested to get in touch with us.**

**Electrical Decorative and Equipment Company**

70 Lombard Street, Toronto, Ont.  
Long distance phone Main 3634

## Here It Is RAPID TOAST-STOVE

TO RETAIL AT \$2.50



Can you beat it at the price?

Immediate Shipment. Standard Package 25.

Liberal Discounts.

Complete with Hubbell Attachment Plug.

**R. E. T. PRINGLE**

901 New Birks Bldg. 308 Tyrell Bldg. 150 Princess St.  
MONTREAL TORONTO WINNIPEG



# *Northern Light*

## SERIES and MULTIPLE LAMPS

➡ THIS COMPARE WITH THIS ⬅

### Nitrogen Filled Tungsten

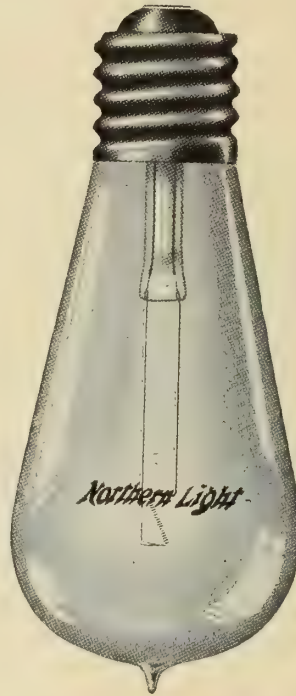
Constant Current Transformer—  
50 KW., 100 c.p. H.E. lamp  
consumes 80  
watts

50000  
—— 625 lamps  
80

If you use H.E. Lamps, you can operate 125 more of the 100 c.p. size 5.5 amp., on a 50 KW Constant Current Transformer than you can Carbon filament Vacuum 100 c.p. 5.5 amp. lamps.

We sell nitrogen filled High Efficiency Multiple lamps in sizes ranging from 200 watts to 1000 watts per lamp.

They make blue look bluer  
They make green look greener  
They make white look whiter  
They make black look blacker  
And everything look brighter



### Vacuum Carbon

Constant Current Transformer—  
50 KW., 100 c.p. carbon  
lamp consumes  
100 watts

50000  
—— 500 lamps  
100

For the same candlepower and amperage—both lamps cost you exactly the same price.

*Ask Our Nearest House*

The life of Northern Light High Efficiency lamps is 1000 hours. They have a "getter" in them which prevents apid blacking.

### *Northern Light*

### Lamps

are made in Canada

by Canadians

for Canadians

Look for the name on every bulb

## *Northern Electric Company*

LIMITED

MONTREAL  
HALIFAX  
TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA





# ***The Best of Everything For Your Next Wiring Jobs***

As an Electrical Contractor you will be interested to know where you can get the best materials, prompt deliveries and fair prices.

The following listing of conduit and wiring specialties only will give you some idea of the reputable lines we carry—each line a quality line—each line guaranteed to build your reputation.

**"GALVADUCT" and "LORICATED" Rigid Iron Conduit.**

**Crouse-Hinds "CONDULETS" and Panel Boards.**

**"T. & B." Outlet Boxes, Locknuts, Bushings, Floor Boxes,  
Fixture Studs and Conduit Fittings.**

**Northern Electric Sheet Steel Switch and Cutout Boxes.**

**"STERLING" Flexible Steel Conduit and Armoured Conductors.**

**"ADANAC" and "IMPERIAL HIGRADE" Rubber Covered**

**Wires. National Metal Moldings and Fittings**

**Northern Electric Tapes and Splicing Compounds.**

Full Stocks of the above, as well as all other Electrical Supplies, carried at each Distributing House.

---

For Catalogues, prices and further information, address our nearest house.

***Northern Electric Company***  
**LIMITED**

MONTREAL  
HALIFAX  
TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA



# The Big Four

## are Revenue Builders for Central Stations.

**B**ECAUSE they open up a new and profitable field for incandescent lighting, the new 400, 500, 750 and 1000-watt multiple MAZDAS are real revenue builders for lighting companies. The 1000-watt MAZDA, for example, brings you as much revenue as three average residences. Besides it is a lot easier and cheaper to put one of these "big fellows" to work than it is to get three new residence customers.

No merchant can afford to let his neighbor's store outshine his own—the comparison is too obvious. He feels that he has to have some of the new lamps himself. Of course his neighbors feel the same way about it. That's how the installations multiply and the revenue grows.

In addition to the stores, there are the theatres, hotels, restaurants, "movies," garages, shops, mills, factories, armories, auditoriums, roof gardens, amusement parks, tennis courts, golf links, skating rinks, dance halls, photographers' studios, piers, railroad stations, yards and concourses and a dozen other places where the high candle-power lamps will be used to advantage.

You will need a large stock of the new lamps to fill the demand your sales' efforts will uncover in your city. Better order now before everybody wants them all at once.

**CANADIAN GENERAL ELECTRIC CO.**  
**LIMITED**

Head Office: Toronto. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert



**Everything Electrical Repaired**  
**NO JOB TOO LARGE**

We specialize in the repair of all kinds of electrical instruments and machinery. Our large staff of experts enables us to give you prompt and efficient service.

Get our prices on the re-winding of motors and generators, over-hauling of switch boards, re-construction of power plants, etc.

One trial will convince you.

**KANALY ELECTRIC COMPANY**

Phone Garry 4359

56 Princess Street - WINNIPEG



**A Safe Crossing**

Protected with National Trolley Guard; the chances of cars being stalled in the path of a locomotive due to trolley jumping are reduced to the absolute minimum.

The expense of this safety is small. Guard is easily installed and requires little maintenance.

For sale by

**The Ohio Brass Co.**

Mansfield, Ohio

**ALUMINUM**  
**ELECTRICAL CONDUCTORS**

Ingot Sheet Wire Rod Tubing

**Northern Aluminum Co.**

1305-6 Traders Bank Bldg. Limited

Toronto, Ont.



**Another Technical Advantage**

The E.A.C. High Torque Single Phase Meter is designed on conservative lines and has a 50% overload capacity in pressure and 100% overload capacity in current.

The High Torque provided (9 cm. grs.) enables the instruments to run accurately in adverse circumstances and to overcome such friction which may establish itself in the course of time. If you will compare the size of wire employed in the series system, the size of the magnet provided and the size of the shunt coil with the same parts of many other meters now on the market, you will see why the E.A.C. meter has the above mentioned advantages, and you will realize why it will pay you to use it on your mains.

For the next Technical Advantage  
 see Ad. in the issue of Dec. 15.



**The Electrical Apparatus Co., Limited**

—Vauxhall Works—

South Lambeth Rd., London S. W., England

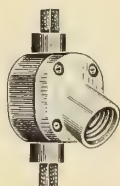
Telegrams:—Elapratrus, London.

ABC Code 5th Edition.



# "Unilets"

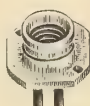
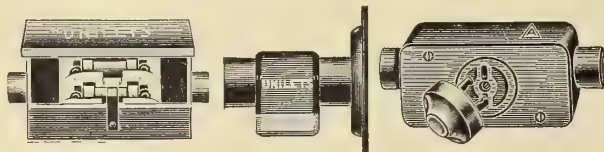
"A fitting for every fit. The most adaptable and flexible units on the market."



"UNILETS," being drawn from steel, are very much lighter than cast-iron fittings for the same size conduit, yet possess greater mechanical strength, and due to their thin-wall construction allow at least 50 per cent. more wiring space than other fittings of similar type.

"Unilets," because of their lightness in weight, are easier for the workman to handle and save considerable in transportation charges and are far more durable and not subject to breakage as are the brittle, cast-iron fittings.

"Unilets" possess many points of superiority over and above other fittings now on the market and to know their true value is to try them on your next job. The conduit is steel, why not the fitting?



"Unilets" are fully described in our new and complete catalogue No. 7, also small booklet, both of which will be sent upon request. Do not delay, write us today, addressing Dept. "D".

## Appleton Electric Company

Main Office  
and Factory

Chicago

212-214  
N. Jefferson St.

For Sale in Canada by

The Mainer Electric Co., Ltd., Winnipeg

Marshall-Wells Co., Ltd., Winnipeg

Chapman & Walker Ltd., Toronto

# PORCELAIN

Knobs, Tubes, Cleats,  
Insulators

Prompt  
Shipments



Best  
Quality

Send for Catalogue

Illinois Electric Porcelain Co.  
Macomb, Ill., U. S. A.

## New Molded Insulation Cover for DOSSERT No. 4 CONNECTOR



No. 4 Insulated Connector

COST SAVING of 21% as compared with price of connector and cover heretofore supplied for small sizes of wire. Range from No. 4 to No. 14, solid or stranded.

**DOSSERT & CO.,** 242 West 41st St.,  
NEW YORK

H. B. LOGAN, PRESIDENT  
IRVING SMITH, Canadian Rep., Unity Bldg., MONTREAL



Why not sell more day current?

### Simplex Electric Household Ranges

make a strong appeal to the housewife for summer use. There must be many homes in your territory in which a Simplex Range could be sold, if its advantages were known. There is a size for every purpose, from the smallest kitchenette to the largest country house. You do yourself a good turn every time you recommend and sell a Simplex Range. It blazes the path for other Simplex goods and larger use of day current.

### SIMPLEX ELECTRIC HEATING CO.

Mfrs. of Everything for Electric Heating and Cooking  
BELLEVILLE, ONT.

CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.  
SAN FRANCISCO, 612 Howard St.

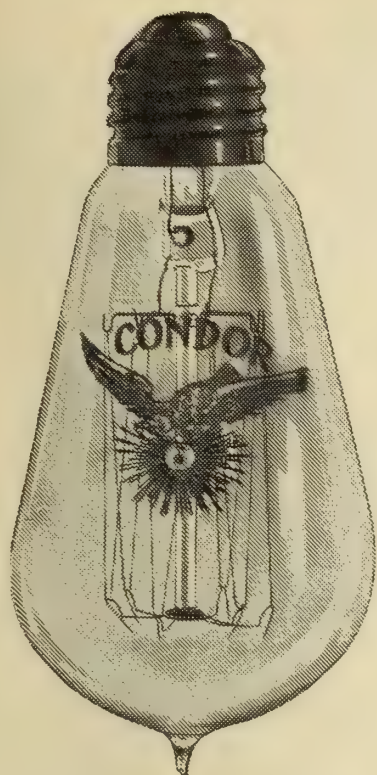
Member of THE RICE LEADERS OF THE WORLD ASSOCIATION



**"BUSINESS MORE THAN USUAL"**

# **"CONDOR" Tungsten Lamps**

*The Lamp that is always reliable*  
**Built Like a Dreadnaught**



"Condor" lamps are designed and manufactured to withstand long and hard service.

Get our prices—no matter if you want 100 or 100,000. Prompt shipments made on all orders—special attention to mail orders.

*Sole Canadian Distributors*

## **C. H. BASTERS & COMPANY**

22 College Street, TORONTO, CANADA

## *The* **FIRE HAZARD**

Do not think only of loss by fire, but guard your employees against electrical accidents.

### **BERRY'S PATENT**

ironclad fuse-switch gear is used in every civilized part of the world, and is absolutely foolproof.

Write for particulars to the sole agents in your territory:—

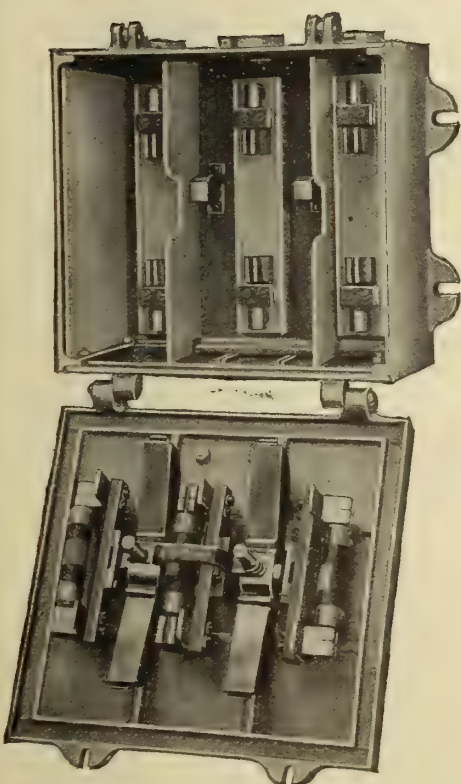
**FEDERAL ENGINEERING CO., Limited**

**GENERAL SUPPLIES, Limited**

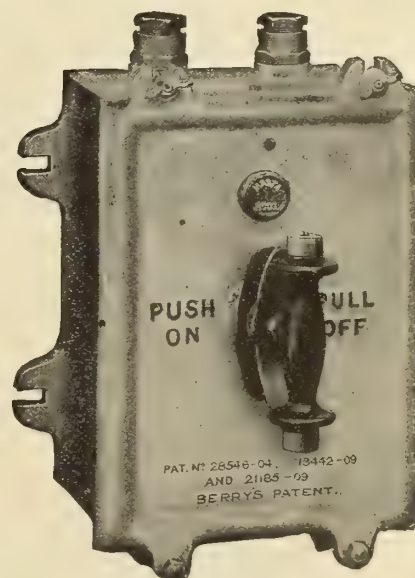
**CANADIAN-BRITISH ENGINEERING Co., Limited.**

122 Eleventh Avenue West, CALGARY

324 Smith Street, WINNIPEG



T. P. "Masta" Patent Fused-Switch with National Standard Code Fuses.



D. P. "Masta" Fused-Switch Weather-tight Type.

**Berry, Skinner & Company, 78 Upper Thames Street, London, E. C., England**





\$39.50 **EUREKA** \$39.50

## The Best Cleaner at a Lower Price

Since the efficient Eureka vacuum cleaner was placed on the market its sales have been increasing by leaps and bounds. We are now marketing them in such large quantities that we are able to make a substantial reduction in price. \$5.50 is the reduction.

The Eureka retail price is now

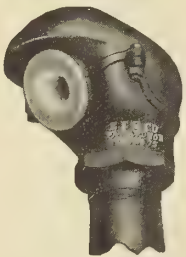
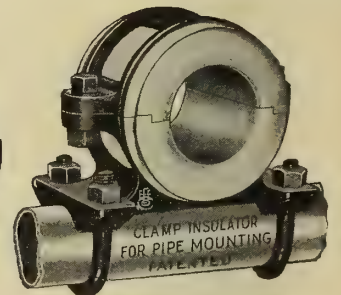
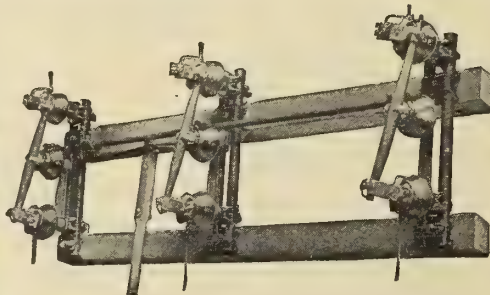
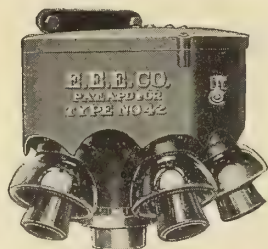
Winnipeg and the West \$44.50

East of Winnipeg \$39.50

Complete set of attachments \$10. extra.

*Write us for dealers' proposition.*

**Onward Mfg. Co.**  
Berlin, Ont.



### SAFETY FIRST!

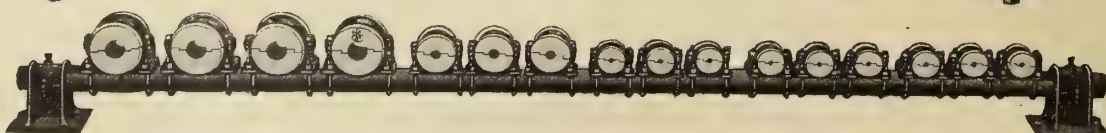
is assured when your station is equipped with our Power Plant Specialties. Let our Engineering Department help you with your layout. Orders received, shipped and billed the same day.

Write for our Bulletins 101 and 102 covering revised prices and new types.

**Electrical Engineers Equipment Co.**  
711-715 W. Meridian St., Chicago, Ill.

**Northern Electric Company**  
LIMITED

Canadian Agents  
Montreal Halifax Toronto Winnipeg Regina  
Calgary Edmonton Vancouver







Published Semi-Monthly By

## HUGH C. MACLEAN, LIMITED,

HUGH C. MacLEAN, Winnipeg, President.

THOMAS S. YOUNG, General Manager.

HEAD OFFICE - 347 Adelaide Street West, TORONTO  
Telephone A. 2700

MONTREAL - Telephone Main 2299 - 119 Board of Trade

WINNIPEG - Telephone Garry 856 - 302 Travellers' Bldg.

VANCOUVER - Tel. Seymour 2013 - Hutchison Block

NEW YORK - Tel. 3108 Beekman - 628 Tribune Building

CHICAGO - Tel. Central 6403 - 1155 Peoples Gas Building

LONDON, ENG. - - - - - 3 Regent St. S.W.

### ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

### SUBSCRIBERS

The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for \$2.00 per annum. United States and foreign, \$2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Authorized by the Postmaster General for Canada, for transmission as second class matter.

Entered as second class matter July 18th, 1914, at the Postoffice at Buffalo, N.Y., under the Act of Congress of March 3, 1879.

Vol. 23

Toronto, October 15, 1914

No. 20

## Municipal Control vs. Ownership

As between private ownership of electric railways—which, in the eyes of the public, often means a sacrifice of good service for the sake of dividends—and municipal ownership and management—which, in its effort to serve the public at a low cost, often results in financial failure—there seems to be a middle course, a sort of partnership arrangement which is working out fairly satisfactorily in a number of cities in the United States. This course is a combination, varying in the different cities, of private ownership and municipal control and appears to have met with a very gratifying measure of success in Cleveland, Chicago and Kansas City.

In spite of the strong wave of municipal ownership feeling that has swept Canada in the last few years, there has always been a strong conservative, practical element among our citizens, who, though they recognize the force of the municipal arguments in theory, still are unconvinced—owing to certain human weaknesses, which we all deplore, of course, and will probably remedy in time—of the workableness, at the present stage of human development, of such a scheme in practice. This conservative element believes in the middle course and points to such a successful Canadian example of the above-mentioned partnership arrangement as the Consumers' Gas Company of Toronto. This company is restricted in its dividends to a certain percentage, and earnings in excess of this amount are used to reduce the price of gas to the consumer; the city owns a percentage of the stock of the company, and has representation on the board.

Friction between the consumer and the company is very rare and the price of gas is so reasonable that it has constituted in the past a very real competitor to electricity—this indeed is still true in the item of cooking.

Mr. Bion J. Arnold, chairman of the Board of Supervising Engineers, Chicago Traction, and well known in Canadian electric railway circles, writes an interesting article in the current number of the Electric Railway Journal, reproduced elsewhere in this issue, on the "Financial Relations Between Cities and Utilities," in which he states that, during the past seven years, the railway companies of the city of Chicago have paid about \$14,000,000 in cash into the city treasury, and estimates that this fund, with accrued interest, will amount to approximately \$90,000,000 by the end of the twenty-year franchise. Commenting on the Kansas City plan, Mr. Arnold also says:—"Kansas City has the best solution of the partnership arrangement so far worked out." By this arrangement the company is allowed to pay 6 per cent. only on a fixed property valuation, all excess being placed in an amortization fund to be used in gradually reducing the intangible value of the property.

## New Offices of "Electrical News"

The illustration herewith shows the new offices of the Electrical News in the MacLean Building, 347 Adelaide Street West (east of Spadina Avenue). Toronto. Readers



New offices, Adelaide and Charlotte Streets, Toronto.

are requested to note the change of address. The Telephone numbers have also been changed and a switchboard installed to provide a more adequate service. Hereafter all Departments will be reached by calling Adelaide 2700.

## Correct Store Lighting

There is a harvest at this season of the year for the central station and the electrical contractor in the better lighting of stores of all kinds. In our cities and larger towns, tremendous progress has been noted in the last year or two, but there are many of the smaller towns and villages where the idea of brightening up has scarcely penetrated. Perhaps the process of education is a tedious one, but possibly also, in some cases, the central station manager has not sufficiently appreciated the possibilities of store and window lighting in the way of increasing his revenue.

This is especially true of window and sign lighting, which is not, in the main, a peakload proposition. Rightly



or not, people are on the streets at night, generally with an open mind, ready to grasp impressions the progressive store-keeper offers through his window displays. This is the time sales are really made, if the customer sees what he wants, although the actual exchange of money and merchandise may not take place until the next day or at a later period. The point we wish to emphasize is that a well lighted window display is the best possible method the merchant can follow of advertising. The failure of a retailer to make his windows attract, invite and advertise, as long as there are people on the street to look at them, is about equivalent to buying space in the local paper and leaving it blank, or to distributing blank circulars. Are the central station men driving this fact home with sufficient force and frequency?

We ask particular attention to a splendid article on store and window lighting and decorating in this issue's Illuminating Section, by Mr. E. N. Hyde. In this article it is, of course, taken for granted that the retailer has already learned the value of his windows and Mr. Hyde simply points out, in a scientific way, how he may make the most of his advertising. The windows treated of in this article have special reference to the boot and shoe business, though the application is general. A brief space is also given to the various types of reflectors now available. In equipping the store window with lights and reflectors, it must be borne in mind that the quality of the illumination is quite as important as the quantity of light.

## Business As Usual

In order to obtain a general expression of opinion on electrical trade prospects in Canada, the Electrical News recently addressed a brief request to a limited number of prominent Canadian electrical men. So far as replies have been received to date, there is no sign of pessimism, but instead, a strong underlying tone of confidence that Canada will emerge from the present period of depression as a much more important country in the eyes of the world than she was before the war began. One of these letters is from Mr. T. Ahearn, president of the Ottawa Electric Company who closes a very hopeful letter with, "All that is required is faith in the resources of our country and confidence in the ability of Canadians to develop these unbounded resources."

Two typical letters are those received from Mr. George Kidd, general manager of the British Columbia Electric Railway Company, Vancouver, and Mr. Geo. C. Rough, secretary and sales manager of the Packard Electric Company. Mr. Kidd writes:

"I look forward with confidence to the prospects for business in the future, and believe that the present temporary halt in the development of the West will in the end prove very beneficial to all concerned, as it will give us an opportunity to thoroughly overhaul our various undertakings preparatory to the further development which we believe will take place at no distant date, and should be very materially assisted by the increase in trade which we all hope Canada will enjoy on the termination of hostilities in Europe."

Mr. Rough heads his letter "Business as usual," and is evidently taking as his motto "Don't talk war, talk business." We quote the following from Mr. Rough's letter:

"We are not by any means going around clothed in a cloak of gloom and pessimism, nor are we trying to 'jolly' ourselves into believing that we are floating on the silver clouds of optimistic enthusiasm, but we are **doing business as usual**, quiet, sober and industrious like; looking forward with all confidence to the future, and that future, we believe, not very remote, when trade conditions will not only become normal, but will be far beyond anything that the rapid development of our Country has warranted in the past."

## Growing Times in Winnipeg

While it is generally conceded by the large business houses that a considerable falling off in business has occurred during the last month or so, the opposite would appear to be the case with the light and power business. The City Light and Power Department report that the increase in their business has been greater during the last five weeks than at any previous time since the beginning of the year. There has been a gradual increase each week from 152 new customers in week ending August 22nd. to 179 new customers in week ending September 19th. The net total number of customers on September 19th was 30,898.

This rapid increase in load has necessitated considerable new construction work. Two new 5,000 kw. generators with turbines, transformers and complete switching equipment now being installed at the generating station will be ready for use by the end of the month. This will bring the capacity of the station to approximately 40,000 h.p. One of the two new 6,000 kw. synchronous condensers being installed at the Terminal Station has arrived in the city and is now being erected. A new tie line to take care of the increased load at No. 1 and No. 2 sub-stations is being installed by the Canadian-British Insulated Company. This is 13,000 volts, 250,000c.m., 3-core, paper insulated, lead covered cable. Work on the footings of the new transmission line has been practically completed and, although the main contract for towers has not yet been let, the Dominion Bridge Company has been awarded the contract for special crossing towers.

Nothing definite having yet been done by the power companies, it is understood that a special order will be issued in a few days by Judge Robson, enforcing the adoption of the grounded secondary system of overhead distribution.

A new experiment in routeing the street cars has been tried during the last week and has caused considerable dissatisfaction to the residents in certain parts of the city. This is the third attempt to obtain a service acceptable to all, and it is now the intention to place this matter in the hands of Judge Robson, who will act in conjunction with Traffic Supervisor Lewis, Winnipeg Electric Railway Company and the City of Winnipeg in an attempt to obtain a satisfactory solution.

## Standardization of Plugs and Receptacles

On other pages of this issue, we print extracts from an address by Mr. T. I. Jones before the recent annual convention of the National Electrical Contractors' Association. Mr. Jones speaks with authority on account of his wide experience with the Edison interests in Brooklyn, N.Y., but probably the most interesting topic touched on in his address was that of the inconvenience and dissatisfaction caused by the lack of standardization in plugs and receptacles. The average householder who has learned the good habit of equipping his home with electrical appliances of various sorts, has also learned to regret that the number of plugs with which a piece of electrical apparatus can be equipped are practically legion. Unless it be for the ordinary screw base no two pieces of equipment will ever, by any possible chance, be supplied with the same kind of plug. Aside from the inconvenience caused by this variety, there is the added expense and trouble involved in replacing the plug with which your new iron or toaster or kettle or sweeper may be equipped, for the plug the purchaser has standardized in his own home. Indeed, the lack of standardization has been carried to the extent often of receptacles of different kinds being placed in the same residence, to correspond, possibly, with different kinds of plugs that have been previously purchased.

With so many manufacturers in competition the ques-



tion of standardization is indeed a very difficult one. No organization is in a position to say that any certain plug and receptacle possesses qualities greatly superior to any other. As Mr. Jones points out, the only possible way seems to be to get manufacturers together, and it is difficult to foresee what could result if they did get together. The chaotic condition of this section of the electrical contractors' work is very unfortunate, but we believe at the present time no assistance can be given beyond the standardization in individual buildings and perhaps a little greater flexibility on the part of dealers themselves, so that they can supply a customer with any particular plug he may require. Beyond this, the only thing seems to be for electrical contractors and manufacturers to be on the watch for anything that may tend towards the desired end.

## German Electrical Trade

The following interesting item appears in the *Electrical World*, New York, under date of October 3rd, regarding the unsettled state of electrical trade in Germany. One may well compare with this the regular publication of the British magazines covering the same field and the unaffected prices and delivery. A quite noticeable increase in the price of German electrical equipment is indicated. The item is as follows:

German electrical papers are reaching here. The *Elektrotechnische Zeitschrift* announced in a statement of editors and publishers on the front page of the issue of August 13 that for the present further issues would not be regularly published, but that larger issues would be brought out at irregular intervals.

Since then another number (Nos. 34-35) has been issued on August 27. The number of advertising pages is reduced, but the text pages do not differ from ordinary issues. There are technical articles as usual, without any reference to the war.

On the last pages of the issue of August 27 the war is mentioned. There are brief obituaries of Prof. Karl Baedeker, of the University of Jena, and Dr. Friedrich Erb, of the Telefunken company, who were killed as officers of the German army at the French frontier.

A war committee (*Kriegsausschuss*) of the German industry has been formed. This will act in co-operation with the government and the banks. The objects are the systematic distribution of employees and workmen in industry and agriculture and early information on emergency laws and emergency measures of the government (for instance, a lengthening of the time allowance for replies to the patent office, etc.).

The *Allgemeine Elektrizitäts Gesellschaft*, *Bergmann Company*, the *Siemens-Schuckert Company*, the *Maffei-Schwartzkopff Company*, *Paul Meyer*, *Brown Boveri & Company* and others have raised prices 10 per cent. for dynamos, motors, fans, pumps, drills, starters, regulating rheostats, controllers, oil switches and traction material, and 20 per cent. for transformers and automatic circuit-breakers. For dynamos above 100 kw. and transformers above 500 kv.a. the list prices have been cancelled. Storage battery quotations also have been withdrawn owing to the shortage of lead.

An article in the *Elektrotechnische Zeitschrift* of August 27 shows that the countries at war in the middle of August have a population of 350,000,000. Of the business done in 1913 by Germany with this population  $3\frac{1}{4}$  per cent. comprised electrical equipment. Exclusive of Montenegro, the German manufacturers in 1913 did a total business of \$5,832,250 with Austria-Hungary, \$5,436,250 with Belgium, \$4,597,750 with France, \$8,605,250 with England, \$9,900,250 with Russia, and \$73,000 with Serbia. Of Germany's electrical exports, 34.62 per cent. was with its present European opponents.

## Power House Architecture

In further reference to possible improvements in the architecture of power houses, regarding which we published certain articles and correspondence in recent issues, we have just received the following letter and photograph. It is very satisfactory to note the general opinion running through all these letters to the effect that great improvements are possible at little or no increase in cost. Such a building as we reproduce below is indeed a fine asset for any Canadian town.



A fine architectural asset for any Canadian town.

and a worthy example to its citizens, who are certain to be inspired thereby to increased pride and interest in the attractiveness of their own property.

Editor *Electrical News*,

347 Adelaide Street West, Toronto.

I certainly think that some of the power houses which we build might be made somewhat more beautiful at little or no increased cost and where these power houses are anywhere near civilization I think this should be done, if possible. The real difficulty is, as a rule, that most engineering offices can hardly afford the luxury of a good architectural draughtsman, and the engineering draughtsman who has in hand the design of the details of the building has not sufficient experience architecturally to do as well as he might with the material used.

The enclosed photograph shows the Electric Power Company's sub-station at Belleville, Ontario, where 44,000 volt power is stepped down to 2,300 volts for distribution in Belleville.

I think that this is a good example of a little additional money spent, producing good results as far as a trim looking station and surroundings are concerned. I hope you will go on reminding us from time to time with regard to the things that we might easily do somewhat better than they are done.

Yours very truly,

(Signed) A. L. Mudge.

Toronto, October 5, 1914.

By permission of the Militia Department of the Montreal Board of Control, Mr. Georges Janin, chief engineer of the city of Montreal, has gone to the front. Mr. Janin was formerly an officer in the French army, and came to Canada in 1892. Before leaving Montreal, he raised a corps of engineers which he will command, composed largely of young men attached to the city engineer's department. Mr. Janin has three sons also fighting in the French army.



## Electrical Exports From Germany

We are indebted to the office of the Chief Trade Statistician through Mr. F. C. T. O'Hara, deputy minister of the Department of Trade and Commerce, Ottawa, for the following information regarding the exports from Germany, together with the portions sent to Canada, of electro-technical apparatus during the year ended December 31, 1912, the latest published records.

Classification	Total Exports Value Approx. \$	To Canada Value Approx. \$
Dynamos, electric motors, continuous current transformers, converters and and reaction coils . . . . .	12,822,500	6,750
Ready fitted armatures and commutators . . . . .	1,938,000	.....
Accumulators and their electrodes:		
Not combined with celluloid, similar moulding materials and vulcanite ..	1,622,250	.....
Combined with celluloid, similar moulding materials and vulcanite ..	193,750	.....
Cable for conducting electric current and intended to be laid under water or in the earth . . . . .	8,065,750	2,500
Arc lamps . . . . .	673,000	2,750
Complete cases for arc lamps in combination with glass globes covered with net work or not; and parts of arc lamps . . . . .	140,500	.....
Reflector and searchlights . . . . .	277,000	.....
Metal thread lamps . . . . .	11,730,500	136,750
Electric incandescent lamps. N. E. S.	865,500	27,000
Electric telegraph appliances . . . .	309,750	.....
Telephones and appliances for . . . .	1,504,500	.....
Electric precautionary and signalling apparatus; parts of . . . . .	933,000	58,250
Electric appliances for lighting and transmission of power or electrolysis	10,584,250	16,000

Appliances for wireless telegraphy, etc.	413,250	.....
Electric appliances for medicinal and dental purposes . . . . .	887,000	1,500
Electric measuring, counting and registering apparatus; parts of . . . . .	4,994,750	18,250
Galvanic and dry batteries and thermoelectric couples; parts of .. . . .	543,750	3,250
Electric appliances for heating and cooking; parts of . . . . .	327,500	500
Insulating appliances of asbestos, asbestos-paste, mica or mikanite for electro-technical purposes . . . . .	180,500	.....
Insulating tubes of paper . . . . .	642,250	1,250
Appliances for electro-technical apparatus, N. E. S. . . . .	275,500	.....
Total exports, 1912 . . . . .	59,924,750	274,750
Total exports, 1911 . . . . .	52,004,250	151,000
Total exports, 1910 . . . . .	54,550,250	73,750

## Low Rates in Windsor

Although the latest town to join the hydro system, Windsor's rates compare very favorably with many of the older towns nearer the centre of the system. As a result of something over 1,300 contracts being signed up to start off with, a floor space rate of 3 cents per 100 feet is being quoted plus a meter rental of 4 cents per kw. hour. This is subject to a discount of 10 per cent. for prompt payment. The floor charge is also subject to a minimum charge of 1,000 square feet and a maximum of 3,000 square feet. The power rate also is exceedingly favorable for a town some 250 miles from the generating station. A basic rate of \$1.00 per h.p. is given plus 3.6 cents per kw. hour for the first 50 hours use of connected load; for the next 50 hours use 2.4 cents and for all consumption above this .3 cents. This also is subject to a 10 per cent. discount for prompt payment.

## STANDARD TYPES

By Charles R. Barrett

### The Man Who Quits

The man who quits has a brain and hand  
As good as the next! but he lacks the sand  
That would make him stick, with a courage stout,  
To whatever he tackles, and fight it out.

He starts with a rush, and a solemn vow  
That he'll soon be showing the others how;  
Then something new strikes his roving eye,  
And his task is left for the bye and bye.

It's up to each man what becomes of him:  
He must find in himself the grit and vim  
That bring success; he can get the skill,  
If he brings to the task a steadfast will.

No man is beaten till he gives in;  
Hard luck can't stand for a cheerful grin;  
The man who fails needs a better excuse  
Than the quitter's whining "What's the use?"

For the man who quits lets his chances slip,  
Just because he's too lazy to keep his grip.  
The man who sticks goes ahead with a shout.  
While the man who quits joins the "down and out."

### The Man Who Sticks

The man who sticks has this lesson learned:  
Success doesn't come by chance—it's earned  
By pounding away; for good hard knocks  
Will make stepping stones of the stumbling blocks.

He knows in his heart that he cannot fail;  
That no ill fortune can make him quail  
While his will is strong and his courage high,  
For he's always good for another try.

He doesn't expect by a single stride  
To jump to the front; he is satisfied  
To do ev'ry day his level best,  
And let the future take care of the rest.

He doesn't believe he's held down by the boss—  
It's work, and not favor, that "gets across."  
So his motto is this: "What another man  
Has been able to handle, I surely can."

For the man who sticks has the sense to see  
He can make himself what he wants to be,  
If he'll off with his coat and pitch right in—  
Why, the man who sticks can't help but win!



# The Value of Telephones In The Bush

Primarily Installed for Fire Protection, but Usefulness Soon Demonstrated in Other Phases of Forest Work—Lines of Riordan Pulp and Paper Co.

By Charles E. Read, Jr.

The Riordan Pulp & Paper Company first considered the idea of building telephones throughout their limits, to assist in the work of Fire Protection, in the spring of the year 1912. We had heard that the River Ouelle Pulp & Paper Company, of St. Pacome, P.Q., had built and were operating bush telephones with great success and we wrote to them for information. They very kindly volunteered their assistance and offered to show a representative of the Riordan company around their lines. Advantage was at once taken of this offer and the company sent their forester to visit St. Pacome, where he secured a great deal of valuable data which governed the initial construction that summer.

When we built our first line we thought only of fire protection and not at all of assisting in our bush operations. In consequence, the first line extended up the slope of Trembling Mountain from the last "Bell" Telephone at the foot to our lookout on the peak. This line through a connection with the "Bell" gave us a direct line between our St. Jovite office (head office for the wood supply department) and our lookout man stationed on this commanding point, over 3,000 feet above sea level and 2,000 feet above the surrounding country.

This line was the most difficult of all to build, for much of the distance was over bare rock from which all vegetation had been swept by successive fires. As there were no trees on this fire-swept rock, and as it was impossible in many places to sink post holes, it was necessary to put in rock bolts, which extended well above the surface of the stone, to hold the insulators through which the wire was run. The method employed was the single wire or ground return, and it was connected with the "Bell" line through a repeating coil.

## Bush Operations Facilitated

This line worked successfully and before the next line was started, the possibilities of the telephone as an assistance in bush operations were recognized. In consequence the intended course of this second line was slightly changed so as to make it of more use in the conduct of our shanties and drives.

Our new line was built on the two-wire or metallic system and was hung from trees, poles being used only where trees were not available. We were also able to connect this line with the local "Bell" service. When these lines were completed and in constant operation, they were found to be so useful to both the work of fire protection and of wood supply that an extensive programme of building was prepared and immediately gone ahead with.

These new plans were designed to be useful so far as possible, for our woods operations, but in no case was the primary object of fire protection overlooked. The first of these new lines followed up the main Rouge River, from the end of the "Bell" service, keeping mostly to the portage road, as this made it much easier to patrol the line in case of breakdowns. Spurs were run into all the company camps, and where a big jobber was on or near the line, a box was put into his shanty free of charge. The line was run on above our last camp to the main storage dams at the head of the river. This last spring, when water was so scarce and driving so difficult, we were saved many hours of water-flow from these storages by the use of the telephone. Formerly it had taken from eight to sixteen hours for a man to

walk from the head of the drive to the dams with orders for the opening and closing. With the telephone this was done by the foreman himself in fewer minutes.

As the gangs come down the river they bring their phones with them, connecting up with the line wherever they camp. In this way, orders can always be given to a gang in the shortest possible time and reports received of their progress at all times.

We also built lines up our two chief branch rivers and last winter each company camp was a long distance station. There was one exception to this as one of our lines only went to the St. Jovite office and did not connect with the "Bell."

## The Cost of Construction

We have found the cost of building a two-wire or metallic line to average about \$90 per mile where we have been able to support the line from trees. If however it is along a road in open country and it is necessary to erect poles the cost is materially increased. For this style of line we use a No. 12 B.W.G. galvanized iron wire which comes in half-mile coils and weighs 165 pounds to the mile. Oak side brackets and glass insulators to the number of thirty or forty per mile are used for support.

A much less expensive line, both in first cost and maintenance, is the one-wire or ground return system. This can be built for about \$55 per mile and for it a No. 9 B.W.G. wire, in half-mile rolls, which weighs 305 pounds per mile, is used. To support this line we use a No. 18 7-strand soft seizing wire which holds a split ring insulator (Thomas No. 22) through which the wire passes. As this insulator only supports the wire and does not prevent a longitudinal slip it is necessary to use an oak bracket and glass insulator several times in each mile. The wire is actually held by the seizing strand to this glass insulator.

After experiment with a number of telephone sets we decided upon the Northern Electric No. 1317P set and with this we used the No. 60-B protector manufactured by the same company. In one case where several hundred feet of wire was destroyed by heavy electric currents from lightning striking the line, this protector arrested the current before it could damage our telephone set. I do not think that anything more need be said as to the advantages of this protector. The cost of a telephone set with the material for its installation is about fifteen or sixteen dollars.

Our costs of construction have divided themselves up about as follows:—

Materials . . . . .	22 per cent.
Labour . . . . .	45 per cent.
Provisions . . . . .	23 per cent.
Teaming . . . . .	10 per cent.

## Fire Prevention Saves Construction Cost

The whole amount expended on our lines might easily be saved, and I feel sure it has been, by getting men to one fire in time to place it under control. As a matter of fact, this last summer, when fires and fire danger were at their height, the telephones proved their value over and over again, by enabling us to send assistance to a ranger in the shortest possible time. The rangers all carry small portable sets and they are able to connect this to the line at any point. Except in the back parts of the limit, it is seldom that a ranger is over five miles in a direct line from the wire.



# Outdoor Sub-stations and Equipments

## Coming to be Recognized as Standard Practice—Some Interesting Details Concerning Their Advantages and Construction Costs

By Mr. H. W. Young\*

The outdoor sub-station, together with weather-proof switching, fusing and protective equipment, now occupies a very definite place in high tension distribution. The purpose of this paper is to bring before your organization some of the outdoor installations which have come under the author's observation during the past few years, and at the same time discuss the entire subject in a general way.

### Field of Outdoor Sub-Stations

The ability to supply large, sparsely settled areas with adequate electric service is largely dependent upon the possibility of installing comparatively small capacity outdoor sub-stations. In many cases the total transformer capacity may be as low as 50 kw., and in the large majority of installations the capacity is less than 150 kw. With these relatively small loads it would be impossible, from an economic standpoint, to construct indoor type sub-stations and employ the form of equipment considered necessary a few years ago.

The logical method of serving these scattered consumers, small communities, etc., is to employ high tension transmission feeders, tapping them at various points by means of the modern low-cost outdoor sub-station. There is no necessity of dwelling on the inevitable superseding of many small generating plants by a few large generating stations from which will radiate high tension feeders, as this is no longer a theory or probability—but is now standard practice. Broadly, it is not a question of whether outdoor high tension equipment will be used, but rather how much does it cost, is it practical and how much equipment can be advantageously used in a given territory?

### The Use of Standard Equipment

When possible it is advisable to use standard or "ready-made" sub-stations, rather than special designs. The prime object in distributing high tension power is to make a profit for the central station. Time is money, and it costs to call in operating engineers to design stations, incur drafting room expense, consume the time of department heads, etc. When it is decided to supply a consumer from the high tension lines, try to use a standard station, as there is a type for practically every service.

The standardization of steel tower outdoor sub-stations by the manufacturer is of real importance to the user, as it eliminates the chance of error—always present when such equipment is designed by local men to whom it is special or unusual work.

### Use of Galvanized Equipment

It is now quite generally recognized that all steel and malleable iron parts should be hot galvanized if possible. This process insures equipment proof against rusting and guarantees a much longer life than it is possible to secure with plain black or painted material. Actual experience has demonstrated the difficulty of thoroughly painting every part of a high tension tower, and the unprotected surfaces will always rust—especially at points of contact or where angles cross. If painted equipment is used, it must be re-coated at rather frequent intervals and in order to paint those parts near the top of a station, it becomes necessary to either discontinue service or endanger the men. A careful consideration of this problem from an operating standpoint has resulted in the general adoption of "hot galvanizing" as a

standard—especially where comparatively light steel angle is used.

### Line Voltage

As the transmission voltage of 33,000 is rapidly becoming a standard, this pressure has been selected in computing the costs shown in the tables and curves accompanying this paper. With a 33,000 volt transmission, a large territory can be economically covered, the equipment is standard, is made in large quantities, is reasonable in cost and can be promptly delivered by the manufacturers.

For the large majority of installations, the local distribution can best be accomplished by a 3-phase delta connected 2,200 volt system which has several advantages, such as permitting the use of standard 2,200 volt transformer at consumer's premises, freedom from short circuits in case of ground on one phase, etc. Again, in many cases, it will be found advisable to operate small power loads with two transformers connected in open delta, and for such installations the 2,200 volt delta distribution is advisable.

### Line Costs

In making up estimates for the installations of outdoor sub-stations, the cost of building a high tension line to cover a given area must always be considered. The net cost per mile of transmission systems varies over a wide range, depending upon local conditions, type of construction employed, etc. The amount of money to be spent on such systems depends largely upon the requirements to be met and whether the work is to be regarded as temporary or permanent. In many instances the tendency has been to adopt rather light construction which cannot be regarded as meeting modern requirements, such as reliability, continuity of service, and permanent work.

The costs given in the accompanying table are based on northern cedar poles, Chicago delivery, and the average prices quoted during August, 1914. Line costs are more or less variable, depending upon market and labor conditions, but the figures given can be safely used for estimating purposes.

It will be noted that No. 10 copper-clad is specified for the telephone circuits, while many companies use No. 12 hard drawn copper. The No. 10 copper-clad is, however, stronger and will give better service than the smaller wire.

Attention is called to the fact that the prices given do not include any percentage for store-room charges, incidentals, etc. There is always some miscellaneous material necessary for transmission lines, the cost of which actually enters into the total cost of the line. It is, therefore, good practice to add five per cent. to the material to cover incidentals.

### Outdoor Sub-Station Costs

When considering the use of outdoor sub-station equipment, one of the first questions is—how much will it cost? As a ready reference in making up preliminary cost estimates, the values given in tables 1, 2 and 3 can be safely used. These costs are based on normal prices quoted during August, 1914.

The data given in table No. 1 is graphically shown in Curves A, B and C, Fig. 1. The data given in table No. 2 is graphically shown in Curves D and E. A curve for table No. 3 would have the same general characteristics as Curves D and E. The rapid decrease in cost per kilowatt with in-

\* President Delta Star Electric Company.



**3-PHASE TRANSMISSION LINE COSTS—33,000 VOLTS**

Using Galvanized "Bo-Arrow" Type Arms, Clamp Pins and Steel Telephone Brackets

SIZE OF LINE

APPROXIMATE NET COST PER MILE OF MATERIAL AND LABOR

Con- ductors No. 0	Size of Poles	Poles and Cross Arms	Insulators and Pins	Ground Wire and Bayonets	Copper Wire	Telephone Line No. 10 Copper Clad	Labor and Supervision	TOTAL COST PER MILE OF LINE
No. 2	35' 7"	42—35' 7" @ \$8.70 ea. 4—40' 7" @ 11.00 ea. 2—45' 7" @ 13.30 ea. 48—Arms @ 1.33 ea.  Total Cost=\$499.84	150 Insulators @ \$.45 ea. 48 (set of 3) clamp pins @ \$.55 ea.  Total Cost=\$93.90	5800 ft. $\frac{3}{8}$ " ground and guy wires @ \$11.50 per M 48 Bayonets @ .57 ea.  Total Cost=\$94.06	5400 lbs. @ \$.16 lb. 75 lbs. No. 4 tie @ \$.16 lb.  Total Cost=\$876.00	320 lbs. @ \$.15½ lb. 48 brackets .10½ ea. 96 insulators @ \$.04½ ea. 96 lags ( $\frac{1}{2}$ "x6") @ .03½ ea.  Total Cost=\$62.32	Labor, teaming Supervision  \$450.00	Poles and arms ..... \$499.84 Insulators and pins..... 93.90 Ground wire & bayonets. 94.06 Conductors and ties.... 876.00 Telephone Line..... 62.32 Labor and Superv..... 450.00  Total Cost.....\$2076.12
No. 2	35' 7"	42—35' 7" @ \$8.70 ea. 4—40' 7" @ 11.00 ea. 2—45' 7" @ 13.30 ea. 48—Arms @ 1.33 ea.  Total Cost=\$499.84	150 Insulators @ \$.45 ea. 48 (set of 3) clamp pins @ \$.55 ea.  Total Cost=\$93.90	5800 ft. $\frac{3}{8}$ " ground and guy wires @ \$11.50 per M 48 Bayonets @ .57 ea.  Total Cost=\$94.06	3500 lbs. @ \$.16 lb. 75 lbs. No. 4 tie @ \$.16 lb.  Total Cost=\$572.00	320 lbs. @ \$.15½ lb. 48 brackets .10½ ea. 96 insulators @ \$.04½ ea. 96 lags ( $\frac{1}{2}$ "x6") @ .03½ ea.  Total Cost=\$62.32	Labor, teaming Supervision  \$425.00	Poles and arms ..... \$499.84 Insulators and pins..... 93.90 Ground wire & bayonets. 94.06 Conductors and ties.... 572.00 Telephone Line..... 62.32 Labor and Superv..... 425.00  \$1747.12
No. 0	30' 7"	36—30' 7" @ \$5.50 ea. 6—35' 7" @ 8.70 ea. 4—40' 7" @ 11.00 ea. 2—45' 7" @ 13.30 ea. 48—Arms @ 1.33 ea. Total Cost=\$384.64	150 Insulators @ \$.45 ea. 48 (set of 3) clamp pins @ \$.55 ea.  Total Cost=\$93.90	5800 ft. $\frac{3}{8}$ " ground and guy wires @ \$11.50 per M 48 Bayonets @ .57 ea.  Total Cost=\$94.06	5400 lbs. @ \$.16 lb. 75 lbs. No. 4 tie @ \$.16 lb.  Total Cost=\$876.00	320 lbs. @ \$.15½ lb. 48 brackets .10½ ea. 96 insulators @ \$.04½ ea. 96 lags ( $\frac{1}{2}$ "x6") @ .03½ ea.  Total Cost=\$62.32	Labor, teaming Supervision  \$425.00	Poles and arms ..... \$384.64 Insulators and pins..... 93.90 Ground wire & bayonets. 94.06 Conductors and ties.... 876.00 Telephone Line..... 62.32 Labor and Superv..... 425.00  \$1935.92
No. 2	30' 7"	36—30' 7" @ \$5.50 ea. 6—35' 7" @ 8.70 ea. 4—40' 7" @ 11.00 ea. 2—45' 7" @ 13.30 ea. 48—Arms @ 1.33 ea. Total Cost=\$384.64	150 Insulators @ \$.45 ea. 48 (set of 3) clamp pins @ \$.55 ea.  Total Cost=\$93.90	5800 ft. $\frac{3}{8}$ " ground and guy wires @ \$11.50 per M 48 Bayonets @ .57 ea.  Total Cost=\$94.06	3500 lbs. @ \$.16 lb. 75 lbs. No. 4 tie @ \$.16 lb.  Total Cost=\$572.00	320 lbs. @ \$.15½ lb. 48 brackets .10½ ea. 96 insulators @ \$.04½ ea. 96 lags ( $\frac{1}{2}$ "x6") @ .03½ ea.  Total Cost=\$62.32	Labor, teaming Supervision  \$400.00	Poles and arms ..... \$384.64 Insulators and pins..... 93.90 Ground wire & bayonets. 94.06 Conductors and ties.... 572.00 Telephone Line..... 62.32 Labor and Superv..... 400.00  \$1606.92

creased capacity of station is worthy of note. This indicates that the original installation should be such that as the load increases the station capacity can be increased at the least possible expense. With the standard control and protective equipment now available it is only necessary to replace the original fuses with others of heavier rating, when increasing the station capacity.

Net Cost. Table No. 1

Net Cost per KW. of Outdoor 3-Phase Sub-Station  
Equipment

Station Capacity	No. of Trans.	Transformer cost per KW 25 Cycles	Cost per KW of High Tension Switching and Protective Units
45	3-15 kw. . . . .	\$25.00	\$20.00
60	3-20 kw. . . . .	20.50	16.50
75	3-25 kw. . . . .	18.00	15.00
90	3-30 kw. . . . .	16.00	13.00
120	3-40 kw. . . . .	12.50	10.50
150	3-50 kw. . . . .	11.00	9.00

Net Cost. Table No. 2

Total Net Cost of Steel Tower 3-Phase Outdoor  
Sub-Station

(With 3 single phase 33,000/2,300 volt transformers)

Station Capacity	No. of Trans.	25 Cycle Station Per KW	Total Cost	60 Cycle Station Per KW	Total Cost
45	3-15 kw. . . . .	\$35.00	\$1,597	\$30.25	\$1,361
60	3-20 kw. . . . .	28.50	1,710	24.50	1,470
75	3-25 kw. . . . .	24.50	1,837	21.50	1,612
90	3-30 kw. . . . .	21.50	1,935	18.25	1,642
120	3-40 kw. . . . .	16.75	2,010	14.50	1,740
150	3-50 kw. . . . .	14.25	2,137	12.00	1,800

Net costs in Table No. 2 include all high tension bus bar supports, copper tube bus, high and low tension dead ends and a galvanized steel tower with footings.

Net Cost. Table No. 3

Total Net Cost of Wooden Pole 3-Phase Outdoor  
Sub-Station

(With 3 single phase 33,000/2,300 volt transformers)

Station Capacity	No. of Trans.	25 Cycle Station Per KW	Total Cost	60 Cycle Station Per KW	Total Cost
45	3-15 kw. . . . .	\$34.25	\$1,541	\$29.35	\$1,321
60	3-20 kw. . . . .	27.00	1,656	23.55	1,415
75	3-25 kw. . . . .	23.60	1,774	20.65	1,550
90	3-30 kw. . . . .	20.60	1,854	17.65	1,589
120	3-40 kw. . . . .	16.20	1,944	13.80	1,656
150	3-50 kw. . . . .	13.95	2,092	11.90	1,785

The costs in Table No. 3 are based on the use of 4, 35 ft. 8 in. top poles.

**Open Delta Installation**

When the original transformer installation consists of two units connected in open delta, the station capacity can be readily increased by adding a third unit of the same type and connecting in closed delta. Where three transformers were originally used, they can be removed and transformers of greater capacity installed—care being taken in the original installation to see that means are provided for readily removing and installing transformers.

**Location of Transformers**

Central station managers contemplating the use of outdoor sub-stations frequently request information as to whether the transformers should be located on or near the ground or at a point higher up. This question can be answered in several ways, as local conditions always govern. Fundamentally, the placing of transformers on platforms any considerable distance from the ground involves additional expense, especially for large size units. The sub-station supporting frames or towers must be heavier than if the transformers were on the ground, and in case of burn-out it is more difficult to remove or replace a damaged unit.

However, by mounting transformers on a platform approximately 12 feet from the ground, certain advantages are



gained. The high tension wiring can be kept up out of the way, fewer high tension bus supports are required and the general factor of safety is materially greater than with wiring near the ground. Another advantage secured by a platform mounting of approximately 12 feet, is that it gives sufficient space for a housing at the base of the sub-station. In this house can be placed all the secondary switches, meters, relays, street lighting regulators, spare parts, etc., thus securing a self-contained sub-station.

In general, it will be found advantageous to place large transformers on or near the ground and mount transformers of 50 kw. or less on a platform 10 to 12 feet above the ground.

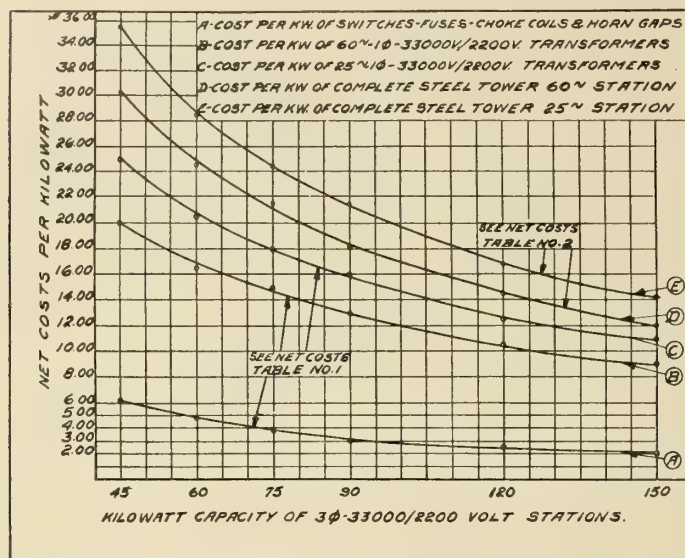


Fig. 1.—Curves showing the results given in above tables.

Provision can be readily made for conveniently and rapidly handling transformers so that in case of failure a defective unit may be quickly removed and replaced.

#### High Tension Fuses

Short circuits on high voltage systems have always ranked among the most potent of trouble makers. If the line is not cleared quickly and completely, serious trouble and destruction may follow. Often the voltage of the entire system will be pulled down, or under severe short circuit con-

ditions the generators, transformers or other apparatus seriously damaged. Again, if short circuits on high tension feeder lines are not cleared quickly the station automatic switches will be operated and the entire main line shut down. For use in connection with relatively small ampere capacity loads, say 50 amperes or less at 33,000 volts, the automatic oil circuit breaker is handicapped, due to its high initial and installation costs.

The practical method of interrupting these high voltage low capacity circuits is by means of fuses which will clear the circuits just as, or even more, quickly than the expensive oil circuit breakers. One of the most successful types developed is the chemical form, consisting of a short fuse wire under tension and hermetically sealed in a glass tube filled with a carbon tetrachloride solution. This form of fuse has the desired characteristics of quick action, minimum disturbance to the system, positive indication whether open or closed, and ready replacement. Aside from exhaustive laboratory tests, this fuse has been in successful commercial operation a sufficient length of time to thoroughly demonstrate its characteristics. Many short circuits have occurred on high capacity systems, and in every instance the fuse has cleared the lines without danger to either the feeders or generating installations.

#### Continuity of Service

Continuity of service as applied to the general distribution system should be maintained at the highest possible standard. An occasional interruption of service to an isolated group of consumers cannot be construed as a criticism of the general service. General interruptions would, however, be very undesirable, and precautions should be taken to prevent them. A too common cause of interruption on high tension systems is due to the failure of insulation; in other words, the line insulators are often too light to meet those abnormal conditions which occasionally arise. The use of liberally designed insulators on the lines, the installation of electrolytic arresters at generating stations or important distribution points, and the frequent installation of air break sectionalizing switches, will materially aid in decreasing interruption to main lines or feeders.

Localization of a disturbance is important, and with the equipment properly installed there is but slight chance of communication to the main system.

## The Proper Course For The Engineer

### A Classical Scientific vs. a Purely Technical Education—The Victories of Peace and Magnificent Achievements in Industry

By Mr. Arthur J. Rowland\*

The idea of a technical course for engineers is relatively new. Like most new things it has had to prove its merit in order to secure proper recognition. It received little sympathy in its beginnings, and even today, when education for definite vocations has won its long battle, many of the older men are apt to think that what was good enough for them ought to be good enough for any one. The headway made by the technical course in recent years shows that it is here to stay; it has definite merit and a definite place in education. I do not undertake to say that the old-fashioned "arts course" has no merit or that it may not form a good foundation for an engineering course in cases where a man has time to pursue both branches of learning. One problem only is considered in this paper. Is the classical-scientific or the technical course the better for the engineering student? The

subjects included in a technical course are those immediately connected with the application or expression of science.

#### Successful Courses Must Have Proper Character

A very important consideration when weighing the relative merits of the classical-scientific vs. the technical course is that which takes into account the elements which make for success.

The act of entering an engineering course and following it, is a purely voluntary act on the part of anyone. A sufficient incentive must then be found to draw students and hold them after they have started. If a course is to be successful, two things are paramount in securing the necessary results: the interest taken in the course, and the value of the reward which is to be secured on graduation.

The attitude of most people, especially in a country like our own, where there is no distinction of class or caste and

\* Read before the A. I. E. E.



where many very humble homes are represented by students in college courses, is to question the value of all the subjects of instruction included in them. A man in one of our elementary evening classes asked, "Why should I go through all this here mathematics to learn a little about motors?" (He was getting decimals, percentage, and simple proportion). A father discussing a college not a thousand miles away where his son was at work, said to me, "It's a place where French and ancient literature form the bulk of the engineering course."

Interest is the element which can be best counted on to make a course successful. The interest of students who really care is held when they are doing the real things of applied science or are studying subjects which manifestly have some bearing on the career they had in mind when entering an institution. The interest taken by the general public in a particular engineering course is often set by the reputation in consulting or research work gained by a man at its head; or by the way in which he is able to keep in the public eye. Even though such a man has no ability as a teacher and habitually neglects his students, his course may be extremely successful for a while at least, merely because of the interest in the man which has been established with the public. But in the long run, it is the way in which engineering knowledge secured in a course of study fits the needs of the community, which counts the most. Every day people in the world are coming more and more to recognize that pure science has its relation to the real interests of the community only in so far as it supports and clarifies the applied science, which is the great community servant. The Cincinnati experiment in co-operative engineering has proved successful mainly on account of the recognition by the community of the value of the professional training given in it. It is surprising to see at how early an age the modern youth takes a definite, practical view of life. It may even be as far back as the first or second year of high school work.

The other incentive which causes men to hold on to the end of a course and graduate is the reward to be secured. This reward may take the form of the diploma or degree which is won; the kind of position which may be secured as the result of the efforts of many and well-organized alumni; the graduate's future standing in the world, gained as the result of the reputation of the institution with which he has been connected. Such rewards are to be given their due weight. A man's future may be influenced as much by them as by any real knowledge he possesses. Such rewards may even make a course apparently successful in which the students really take no interest at all. And yet the best reward is certain to be the self-consciousness that as a graduate a man is trained to think and to work intelligently and efficiently. He is only so trained when he has within his command the tools of his profession along with a thorough knowledge of its principles.

#### Existing Engineering Courses All Have Some Special Characteristics

A large number of the existing engineering courses have been planned on the basis of certain State-established entrance requirements, using curricula developed from the old "arts" courses. They are arranged so that no engineering subject can be reached until calculus is finished, and since this is rarely earlier than the end of the sophomore year, the first part of the course is filled with general education subjects. People who are highly educated in general subjects, who are learned as the result of long culture environment, who know the art of fine writing, and the delights of poetry, approve such courses. Those who know nothing of engineering but have fixed ideas as to what constitutes college education are ready to help to frame them. But what do they mean to the boy who, with his heart set on engi-

neering, never could make anything of the philological side of language or history? He falls out of the running before ever he gets a chance for even a taste of it.

There have been many places where the personal ideas of those who conduct engineering courses have been quite unable to influence very strongly the character of the work offered. Tradition and precedent count for too much. The engineering director of a course in such a place, who has originality and understands the importance of practical training, eventually succumbs to the inevitable.

That something is wrong in the characteristics of many engineering courses is pretty well shown by the lack of fundamental knowledge shown by college graduates who have been given places in the large electric manufacturing companies of the country. Some years ago a book of questions and answers was printed and offered for sale by a couple of men connected with one of these big companies to help student apprentices to required knowledge. I looked over a copy and eventually wrote the authors to ask whether it was possible that graduates in engineering really were ignorant of the answers to most of the questions. The reply I received seemed to indicate it was so; a clear indication, I had to conclude, that practical training was sadly lacking in the courses they had followed.

#### Are Purely Technical Courses Really Successful?

Classical-scientific education leads to conditions like those encountered in the engineering department of a large corporation I visited some months ago. The chief engineer (himself a college man), in reply to a question, said, "I would rather have a man from the tool room in the designing work than any college man." After pointing out a number of men in the room from prominent colleges and universities, he said further, "All they know is how to design a beam to support a fixed load a given number of feet beyond a wall, or other purely textbook problems. How the beam is to be held in the wall, or the load suspended from it, is beyond them." It is a long slow process to train men who have never taken the steps passing from pure to applied science, to take hold of real live problems of the engineering world. They have the principles, perhaps, but do not know how to apply them. In the technical course the very same principles are presented, but would be coupled with applications such that the student comes to feel that they all have a vital, direct relation to practical affairs. The test of knowledge is the ability to think clearly on a new problem, rather than to search the filing cabinet of the brain for the data which show that the new problem is simply a variation of some old one.

In the classical-scientific course, research men may be developed; but too often such men are sadly lacking in the ability to handle practical problems, because of a narrowness of vision. Of course we must recognize, on the other hand, that in such courses, as in those of other non-engineering types, education, no matter in what direction, has a value of its own which all know and appreciate. Association with educated people, living in an environment of cultivation and learning, must produce an uplift, a broadening of view, which is fine to gain. There may be many men taking engineering courses who delight in language study as an art, in the broad reaches of modern and classic literature, and in the theories of pure science; but in this paper I am keeping in mind the man who is an engineer because he is destined to it, whose whole fiber is bound up with thoughts of design and construction. Such a man does not take such a course because he picked it by chance; or because he thought it might prove as interesting as any other. He takes it because there is no other which seems to him half so attractive, half so worth while.

The cultural value of certain kinds of studies is common-



ly urged when championing a classical-scientific course. Now culture is "to know the best that has been said and thought in the world." "The training, development, or strengthening of the powers, mental or physical, or the condition thus produced; improvement or refinement of mind, morals, or tastes; enlightenment or civilization." "Act of improving or developing by education, discipline, etc.; the training, disciplining, or refining of the moral and intellectual nature." On such bases there is as much culture to be found in technical subjects as in any other sort. Is the mind any less cultured which can appreciate a fine piece of reasoning and the direct engineering application, than the one which can appreciate a fine piece of music? Is the technical investigation of transformer theory any less cultural than the reasoning ability developed by logic or ethics? Are we not badly hampered in securing a clear feeling about such matters because of what we have been taught and the precedent of many years of established ideas? The sense in which the term culture is often used seems to indicate that a person who is cultured is for that reason able to shine in society; to talk well with strangers on subjects they know. It seems a pity that people generally cannot better appreciate scientific and engineering subjects. It is a pity if an engineer when he is in "society" must drop all reference to the subjects which command his interest in his daily life.

If securing culture includes gaining a first-rate mental development, I may suggest that, as too often taught, subjects like language and history and even some kinds of science and mathematics are memorizing subjects. It requires no special mental development to gain purely informational knowledge. Scientific and engineering subjects must be thought through and understood. There is no higher culture than the ability to think clearly and well. One who can do this should also be able to express himself clearly and well. I have wondered sometimes whether the so-called culture subjects of some engineering courses were not included as fillers, because to teach them only a class room and a teacher are required and they are relatively inexpensive. Certainly a type of mind typical of the highest type of manhood can be acquired quite as easily through studying technical subjects as through studying Chaucer and medieval German.

#### Technical Courses Have Some Very Distinct Merits

The man whose life work is applied science sees and appreciates the direct application of everything he gets. The Cincinnati co-operative scheme in engineering education is a first-class illustration of this. The difference between the gain of a student whose alert and active interest is held by conscious applications as he reads his text or participates in class discussions, and that secured by the student who blindly grasps at principles and laws in an abstract way, is startling to one who has seen the difference. In our own engineering work the professor of chemistry has recently diverged from the old beaten path of general chemistry, qualitative analysis, etc., to engineering chemistry (really a much harder study). The difference in the class and its attitude toward the work were remarkable. The active interest, the feeling that they were now learning something worth while, were typical of the difference referred to above. The student in the technical course knows that he is being equipped with the tools of his profession. He feels that every hour of work takes him toward the goal he wants to reach. The teacher can count on the interest and attention of his class to such an extent that he may find them impatient at the speed he thinks it safe to make.

The whole trend of modern education is to train for usefulness. Relatively few are so well favored that it is possible for them to consider higher education merely as a

wholesome broadening influence in their lives. Besides this, the immense field of knowledge which is included in engineering nowadays leads to the conclusion that if a reasonable idea of fundamental principles and a little of their application are secured within the length of time most people can afford to give to college, no subjects except those which are technical can be included.

Of the cultural side of a technical course much could be said. While studying engineering, the student gets in an incidental semi-conscious way a knowledge of the victories of peace, and of the magnificent achievements in industry. Such things are certainly of much more real value and more worth knowing about than the trend of things in the world as studied from the standpoint of conquest and war. For there are heroes of engineering today. We find them in the men who are really doing things for their fellow men, making the sum of human happiness steadily greater. More and more we are coming to realize that the men who are bent upon destroying their fellow men and blocking real progress in the world by war or political intrigue are not the heroes for our youth to emulate.

#### The Technical Engineering Course Should Reach Back of College Work

It is but a short space of time since practical subjects taken in the period of school work preceding college entrance began to be counted in securing credits for entrance. Today they are too often discredited, both with reference to entrance and in securing recognition or credit in connection with freshman work. Standard college entrance requirements have forced high and college preparatory schools to a definite kind of training which in many cases does not admit of any engineering subject being studied even in an elementary way, until the college course has been begun. Many and many a parent looking forward from the grammar school period of education, anxious to have the boy trained for some sort of engineering pursuit, gives up the whole thing as hopeless when he finds that six years must pass (four of high school and two of college) before any real engineering subject is touched. There are very many boys between fourteen and sixteen years of age who leave school early in a high school course when they find there is no hope of securing training there in anything they consider practical, anything directly connected with industrial pursuits, wherein they hope eventually to secure their livelihood, their opportunities, and their advancement in life.

Manual training schools have to some extent tried to meet this difficulty, although originally devised purely for general education purposes to train the hand along with the mind and produce an education of the whole man. But they have often gone wrong, and the relation of their work, or rather a lack of relation, to the electrical industries is shown when it is found that, for example, in a large and successful one not far away, students are graduated without ever touching a circuit through which dynamo current flows, or looking through a telescope at the mirror of a reflecting galvanometer.

#### Conclusion

I believe heartily and sincerely in the technical course for engineering students. Whatever the advantages of others, it is my belief that none equals it in yielding rich incentive to scholarship, life interest in one's daily work, and definite hope of rewards to be gained. But I also believe that a far greater need could be met were it possible to start engineering education early in the high school period and distribute the general education subjects commonly found in that period, all the way along to the time of graduation from college.



# "Going After" Business the Only Way to Get It

The Present is No Time to Rest on One's Oars—Business Lost Now will be Hard to Regain—New Customers Gained Now will be Doubly Valuable When Trade Revives

By Mr. A. A. Briggs\*

[Editorial note—In view of the fact that the Dunlop Tire & Rubber Goods Company, Limited, have decided to increase their advertising appropriation at the present time, this summary of conditions which influence national advertisers in making such a decision, will undoubtedly be read with great interest.]

Retrench—"To lessen, to abridge, to curtail"—that's what the dictionary especially calls it.

But hasn't the war so far shown that to retrench means particularly to **dig out a fresh trench**, to secure the means and the assistance to make a new assault on the enemy? In the latter interpretation we undoubtedly find what ought to be the keynote for the present advertising situation in Canada.

The truth is that on one side of the Dominion are ranged people who are following the dictionary's main stipulation of "retrench" for their publicity guidance. They may have reasons for so doing which no one in a different line of production can justly pass an opinion on; but it is also true that on the other side are ranged people who are leading—not following anything or anybody in their advertising policy which does not at once spell **Action**. It cannot be denied that the people who have decided "to lessen, to abridge, to curtail" their publicity are in the ascendancy at the present time. And everywhere the reason advanced is: "The War."

So far, from the standpoint of salesmanship, **no one has adduced a solitary economic reason why Canadian manufacturers who inaugurate advertising campaigns as a regular portion of their selling effort should discontinue that programme at the present time.** And, is it not strange that in all our mental hurrying to and fro, no one has yet proclaimed the fact that the war did not alter the Canadian consumer-purchasing market one iota? It must be understood that in making the above statement we are not dealing with any isolated cases where this particular business or that particular business may have been affected in countless ways other than the selling end. It is true, a manufacturer may have to pay more for his raw materials as one result of the war, but if he can get the materials at all, he always has the instrument of retail price-increase to wield in offsetting his losses, if necessary.

What really did alter the possibilities of the consumer purchasing field in Canada? Not the war, but the lull that antedated the war. A number of reasons precipitated the lull—most of which the public are conversant with. In other words; dull times, if one chooses to call them such, were here anyway—here in the sense that while the consumer was willing to a considerable extent to make purchases, the middleman had in many cases gone rather askew in his financing. The war simply accentuated the fast-spreading inclination to sit tight.

Naturally, during a portion of 1913 and most of 1914, manufacturers, in the main, were conservative in the matter of building extensions and such like, and sales efforts were always linked to due caution. This year, probably more than usual, attention was centred

on the outcome of the Western wheat crop. That crop virtually has arrived, and, if reports are true, it is a good deal larger than advance estimates intimated. Then, notice the price per bushel paid for some wheat at the elevators. The farmers should now assist basic money circulation, which, of course, always commences the upward trend in the retail line.

In seeking out forces for advertising stimulus, it is one thing to deal with the possibilities of new fields of endeavor for Canadian manufacturers and another thing to explain away the measure of uncertainties attached to them. It cannot be gainsayed that consideration of new fields may mean consideration of bonuses and tariffs. What ought to be emphasized is that the Canadian manufacturer has, at least, as much area market as he had previous to the war and the general lull in consumer-buying conditions. Therefore, instead of risking new fields, which at best may be a costly experiment, the natural course seems to be that of again seeking the old field—but **seeking it ten times more forcibly.** This fact is brought home to us with double force when we have evidence aplenty that our friends to the South, in the widespread revival of the export propaganda, are considering the commercial blanketing in this country. It, therefore, behooves the Canadian manufacturer who has advertised in the past, not only to advertise again to create consumer demand for his wares, but to advertise as a means of actually holding what he already has. While suggestions are being made to flank some of the European countries' export business to Canada, we should not allow ourselves to be flanked in a commercial sense by our neighbors across the line.

Those advertising men who passed through the trade siege of 1907 and others before it—which sieges or lulls, or whatever you wish to call them, some bankers say cast their sly glances our way approximately every seven years—know well that **the manufacturers who assumed the defensive in publicity matters on those occasions had a difficult time regaining their stride when normal times returned.** That is natural law in the commercial world. There is no profit in manufacturing, no excuse for a factory's existence, unless the selling end is vigorous. The energy which keeps the selling end vigorous in abnormal times is identically the same energy which keeps it vigorous in normal times—only it is in abnormal times that keeping up the stride is fraught with more discouragements. One hundred courageous manufacturers and five hundred patriotic purchasing agents are worth more to Canada at the present moment than a million sermons or editorials on humaneness in war.

Realizing that one of the big sticks in the commencement of Canada's Comeback is to be wielded by the purchasing agent, every man occupying such a position in Canada, should have a creed something to this effect hung over his desk where he who runs in for an order may read:—

"I have hitched the firm's wagon to the Made-in-Canada star.

"I will specify on all purchases that Canadian ma-

\*Advertising Manager Dunlop Tire & Rubber Goods Co., Limited.



terials must be used or the order will be subject to cancellation.

"I know in so doing that I will thereby be encouraging the other fellow—whose traveller calls on me—to buy my firm's goods and possibly at a higher price, too, than he would have to pay for the foreign article."

Let us be assured that Canadian purchasing agents as a body have lined up behind the Made-in-Canada slogan, and we can expect to see Canadian advertising manufacturers assume the offensive. They will know that if they can secure a portion of the trade which formerly went out of the country, they can afford to write off certain business, the loss of which was consequent on a measure of consumer retrenchment. And let consumers see with their own eyes manufacturers' copy running in the papers and those self-same consumers—assured that the factory in which they are employed is going to keep running or the copy wouldn't be running—will commence again to make purchases with some measure of freedom.

Canadian manufacturers as a body must of necessity exist on Canadian orders; to the great majority "export" is an unused word. Orders will not be secured in dull times by methods that would fail in good times. One of the established beliefs of merchandizing is that properly-placed and properly-managed advertising is a force for facilitating sales. If this were not true, why would certain manufacturers—sixty per cent. of whose output might be styled luxuries—increase rather than decrease their advertising at this very moment?

They realize they have a big job on hand—that of securing orders when orders are unusually hard to secure. And they know full well that following the simple instinct of **going after business is the only solution** to the problem.

## More Standardization Rules

The American Institute of Electrical Engineers has adopted, subject to editorial revision, a number of definitions and rules called "standardization rules." This is the outcome of a large amount of work which has been proceeding since 1898 as the result of the appointment at that time of a Committee on Standardization, the personnel of which has been changed and enlarged from time to time as requirements appeared to demand. The standardization rules include 567 topics. A large number of these are definitions which have reference to subjects of almost daily interest to electrical engineers and operating men. We are reproducing a number of these herewith in addition to others which appeared in our issue of September 15. In these standardized definitions it is to be understood that those about which there can be no misunderstanding are, for the most part, omitted.

**A Double-Current Generator** supplies both direct and alternating currents from the same armature-winding.

**A Converter** is a machine employing mechanical rotation in changing electrical energy from one form into another. A converter may belong to either of several types, as follows:

**A Direct-Current Converter** converts from a direct current to a direct current, usually with a change of voltage. Such a machine may be either a motor-generator or a dynamotor.

**A Synchronous Converter** (also called a rotary converter) converts from an alternating to a direct current, or vice-versa. It is a synchronous machine with a single closed-coil armature.

**A Cascade Converter**, also called a motor converter, is a combination of an induction motor with a synchron-

ous converter, the secondary circuit of the former feeding directly into the armature of the latter; i.e., it is a synchronous converter concatenated with an induction motor.

**A Frequency Converter** converts the power of an alternating-current system from one frequency to another, with or without a change in the number of phases, or in the voltage.

**A Rotary Phase-Converter** converts from an alternating-current system of one or more phases to an alternating-current system of a different number of phases, but of the same frequency.

**A Phase-Modifier**, also called a phase-advancer, is a machine which supplies reactive volt-amperes to the machine; e.g., induction motor, or to the system to which it is connected. Phase modifiers may be either synchronous or asynchronous.

**A Synchronous Phase-Modifier**, sometimes called a synchronous condenser, is a synchronous motor, running either idle or with load, the field excitation of which may be varied so as to modify the power-factor of the system, or through such modification to influence the load voltage. The function of a Synchronous Phase-Modifier is to supply reactive volt-amperes to the system with which it is connected.

**Direct-Current Commutating Machines** comprise a magnetic field of constant polarity, an armature, and a multi-segmental commutator connected therewith. These include: direct-current generators; direct-current motors; direct-current boosters; direct-current motor-generators and dynamotors; direct-current compensators or balancers; and arc machines.

**Alternating-Current Commutating Machines** comprise a magnetic field of alternating polarity, an armature, and multi-segmental commutator connected therewith.

**Synchronous Commutating Machines** include synchronous converters, cascade-converters, and double-current generators.

**Synchronous Machines** comprise a constant magnetic field and an armature receiving or delivering alternating-currents in synchronism with the motion of the machine; i.e., having a frequency strictly proportional to the speed of the machine. They may be sub-divided as follows:

**An Alternator** is a synchronous alternating-current generator, either single-phase or polyphase.

**A Polyphase Alternator** is a polyphase synchronous alternating current generator.

**An Inductor Alternator** is a Synchronous Alternator in which both field and armature windings are stationary and in which masses of iron or inductors, by moving past the coils, alter the magnetic flux through them. It may be either single-phase or polyphase.

**A Synchronous Motor** is a machine structurally identical with a synchronous alternator, but operated as a motor.

**An Induction Motor** is an alternating-current motor, either single-phase or polyphase, comprising independent primary and secondary windings, one of which, usually the secondary, is on the rotating member. The secondary winding receives power from the primary by electromagnetic induction.

**An Induction Generator** is a machine structurally identical with an induction motor, but driven above synchronous speed as an alternating-current generator.

**Unipolar or Acyclic Machines** are direct-current machines, in which the voltage generated in the active conductors maintains the same direction with respect to those conductors.

**Stationary Induction Apparatus** changes electric energy



to electric energy through the medium of magnetic energy without mechanical motion. It comprises several forms, distinguished as follows:

**Transformers**, in which the primary and secondary windings are ordinarily insulated one from another.

The terms "**high-voltage**" and "**low-voltage**" are used to distinguish the winding having the greater from that having the lesser number of turns. The terms "**primary**" and "**secondary**" serve to distinguish the windings in regard to energy flow, the primary being that which receives the energy from the supply circuit, and the secondary that which receives the energy by induction from the primary.

The **rated current of a constant-potential transformer** is that secondary current which, multiplied by the rated-load secondary voltage, gives the kv.a. rated output. That is, a transformer of given kv.a. rating must be capable of delivering the rated output at rated secondary voltage, while the primary impressed voltage is increased to whatever value is necessary to give rated secondary voltage.

The rated primary voltage of a constant-potential transformer is the rated secondary voltage multiplied by the turn ratio.

The **voltage ratio** of a transformer is the ratio of the r.m.s. primary terminal voltage to the r.m.s. secondary terminal voltage under specified conditions of load.

The "**current ratio**" of a current-transformer is the ratio of r.m.s. primary current to r.m.s. secondary current under specified conditions of load.

The **ratio of a transformer**, unless otherwise specified, shall be the ratio of the number of turns in the high-voltage winding to that in the low-voltage winding; i.e., the "turn-ratio."

The "**marked ratio**" of an instrument transformer is the ratio which the apparatus is designed to possess under average conditions of use. When a precise ratio is required, it is necessary to specify the voltage, frequency, load and power factor of the load.

**Auto-transformers** have a part of their turns common to both primary and secondary circuits.

**Voltage Regulators** have turns in shunt and turns in series with the circuit, so arranged that the voltage ratio of the transformation or the phase relation between the circuit-voltages is variable at will. They are of the following three classes:

**Contact Voltage Regulators**, in which the number of turns in one or both of the coils is adjustable.

**Induction Voltage Regulators**, in which the relative positions of the primary and secondary coils are adjustable.

**Magneto Voltage Regulators**, in which the direction of the magnetic flux with respect to the coils is adjustable.

**Reactors or Reactance-Coils**, also called Choke Coils; a form of stationary induction apparatus used to supply reactance or to produce phase displacement.

An **Ammeter** is a measuring instrument, indicating in amperes.

A **Voltmeter** is a measuring instrument, indicating in volts.

A **Wattmeter** is an instrument for measuring electrical power, indicating in watts.

**Recording Ammeters, Voltmeters, Wattmeters, etc.**, are instruments which record graphically upon a time-chart the values of the quantities they measure.

A **Watt-hour Meter** is an instrument for registering watt-hours. This term is to be preferred to the term "integrating wattmeter."

A **Line-Drop Voltmeter Compensator** is a device in con-

nection with a voltmeter, which causes the latter to indicate the voltage at some distant point of the circuit.

A **Synchroscope**, sometimes called **Synchronoscope**, is a device which, in addition to indicating synchronism, shows whether the machine to be synchronized is fast or slow.

A **Generator** is a machine which transforms mechanical power into electrical power.

A **Motor** transforms electrical power into mechanical power.

A **Booster** is a generator inserted in series in a circuit to change its voltage. It may be driven by an electric motor (in which case it is termed a motor-booster) or otherwise.

A **Motor-Generator** is a transforming device consisting of a motor mechanically coupled to one or more generators.

A **Dynamotor** is a transforming device combining both motor and generator action in one magnetic field, either with two armatures, or with one armature having two separate windings and independent commutators.

A **Direct-Current Compensator or Balancer** comprises two or more similar direct-current machines (usually with shunt or compound excitation) directly coupled to each other and connected in series across the outer conductors of a multiple-wire system of distribution, for the purpose of maintaining the potentials of the intermediate wires of the system, which are connected to the junction points between the machines.

A **Reactor** is a coil, winding or conductor commonly known as a reactance coil or choke coil, possessing inductance, the reactance of which is used for the operation, protection or control of a circuit or circuits.

The **Efficiency** of an electrical machine or apparatus is the ratio of its useful output to its total input.

## Personals

**Mr. Chalmers**, public utilities commissioner of Edmonton since January, 1912, has resigned.

**Mr. Robert Dakin** has been appointed electric wiring inspector for the towns of Galt, Preston and Hespeler.

**Hon. I. B. Lucas**, provincial treasurer of the Ontario Government, has been appointed a member of the Hydro-electric Power Commission of Ontario, succeeding Col. Hendrie.

**Lieut.-Col. Hon. J. S. Hendrie**, member of the Hydro-electric Power Commission of Ontario since its creation some years ago, has been appointed Lieutenant-Governor of the Province of Ontario.

**Mr. R. M. Milan**, Saskatoon, has been appointed electrical superintendent of the Dominion Government interior storage elevator at Moose Jaw. Mr. Milan will have charge both of the installation and operation of the elevator.

**Mr. R. F. Morkill**, signal engineer of the Grand Trunk Railway, who contributed an article on "Automatic Signals on Victoria Bridge," to our issue of September 15, has left for the front. He is a lieutenant of the engineering corps. Mr. Morkill was engaged in the Boer war.

**Mr. Joseph Townsley**, well known in the Canadian telegraph field, is dead. Mr. Townsley superintended the building of the C. P. R. telegraph system east to Halifax and Kansas, and continued as superintendent of C. P. R. telegraphs until his retirement, on pension, in 1911.

**Mr. Parker H. Kemble**, formerly of Toronto Electric Light Company fame, has resigned his position as manager of the Electrical Commercial Department of the Union Gas and Electric Company, Cincinnati, on account of ill health. Mr. Kemble is said to be planning a house-boat trip with his family on the Ohio, Cumberland and Mississippi rivers.



# Electric Railways

## Financial Relations Between Cities and Utilities —By Bion J. Arnold, Chairman Board of Supervising Engineers, Chicago Traction\*

In a number of cities in this country arrangements of one sort and another have been made recently by which the municipalities share directly in the profits of the local electric railways and exert managerial influence in their operation. This movement is so vital in its nature and so far reaching in its consequences that each experiment must be studied carefully in order that its lessons may be well and promptly learned.

The partnership arrangement in Chicago has now been in operation for seven years, long enough for the determination of the wisdom of its provisions. It will be remembered that the city agreed with the railroad companies, as a condition preliminary to any settlement, that a valuation should be made and agreed upon which should be accepted as the initial price of the property. The difference between this amount and that of the outstanding securities was to be either sacrificed by the holders thereof or taken care of out of such net profits as the companies were allowed to make under the ordinances.

The railway companies saw fit to make this arrangement because almost every main franchise had expired, and operation was being conducted under temporary permits in the business districts of the city. One of the companies contended that it had a ninety-nine-year franchise under a certain ruling of the Illinois Supreme Court, but shortly after the settlement was made the United States Supreme Court ruled otherwise.

The valuation ultimately agreed upon was \$50,000,000, the city allowing actually \$11,000,000 more than the physical property was considered to be worth, partly because the legal decision mentioned above had not been handed down when the agreement was concluded and partly as the price of peace. Thus the \$11,000,000 was in reality mainly allowed for unexpired ordinances and obsolete plants.

### Rehabilitation of the property

The most important provision made in the arrangement was that for the rehabilitation of the property and the extension of the system under public supervision. The agreed purchase price to the city, which is practically the bonding limit of the companies, was to be increased by the amount of the expenditures made for these purposes, and the expenditures were to be authorized by a board consisting of three men, one representing the city, one the company, while the third was to be chosen by both. The last-named was to be independent of both interests and his name was to be written into the ordinance. During the past seven years under this arrangement the purchase price to the city has been increased to about \$140,000,000 by the cost of the rehabilitation of the old property and by extension to it.

A second important provision of the contract provided

for the acquisition of the railway property at any time by the city upon six months' notice, the price at any time to be the original \$50,000,000, plus the amounts that had been added for rehabilitation work and extensions with the approval of the board. This will continue to increase by the method mentioned until in 1927, when the present twenty-year franchise expires. The amount will then be about \$204,000,000.

A third provision is concerned with operation. The city granted a twenty-year franchise to the company, the maximum which could be granted under the state laws. The company operates the property, paying all operating expenses, including maintenance, insurance, taxes and a contribution to a renewal and damage fund, and receive five per cent. interest upon the agreed purchase price of \$50,000,000 plus additions as above. The balance of the receipts is divided between the company and the city, 45 per cent. to the companies and 55 per cent. to the city. During seven years the companies have paid themselves 7 per cent. on their investment, including the above 5 per cent. interest, and have put about \$14,000,000 in cash into the city treasury. By the end of twenty years I estimate that there will have been so deposited a fund, which if invested in suitable securities netting 5 per cent. income will, with accrued interest, amount to \$90,000,000 at the end of the twenty-year period. The city can then buy for \$114,000,000, which is \$204,000,000 less this \$90,000,000, a property having a tangible value of \$150,000,000. In other words, this fund which the companies are putting into the city treasury is in reality an amortization fund, if it is allowed to accumulate properly, although it is not so called. It is thus seen that the price of the properties is automatically fixed and the machinery provided so that the city can acquire them at any time without dispute. When it is remembered that the present scheme was worked out after the municipality had endeavored to inaugurate municipal ownership, the wisdom of the present arrangement is obvious, as such ownership is automatically provided for whenever it is deemed necessary.

### Intangible Assets

The question may be raised as to why there will not be a property worth \$204,000,000 at the termination of the franchise. In the first place the new arrangement started with \$11,000,000 in intangible assets. The railways of Chicago first operated horse cars, then cable equipment was substituted, next light electric cars were used and finally heavier electric cars became necessary. Thus not only was the sum of \$11,000,000 paid for "junk" and franchises, as previously stated, but provision had to be made for the old cable system, obsolete cars, etc., which had to be eliminated and for 400 miles of track which had to be rehabilitated.

We made a mistake, some of us now believe, when the ordinance was passed in not providing that all or at least some of the profits should be used as an amortization fund for the purpose of retiring this intangible value. This will probably be rectified in the consolidation plan now being worked out under which it is proposed that the surface, elevated and subway lines will be operated as one system.

\*In Electric Railway Journal.



The city of Cleveland made a solution of the traction problem quite different from the Chicago plan. Instead of an agreed purchase price a certain capitalization was agreed upon, and the company was allowed to earn 6 per cent. upon that capitalization and no more. This capitalization may be increased from time to time under the supervision of a city railway commissioner. The fare was also reduced to 3 cents with provision for increase under certain conditions. That is, there was incorporated in the franchise a clause providing some flexibility by stipulating that if a reserve fund of from \$300,000 to \$500,000, established by the terms of the ordinance, cannot be maintained with a 3-cent fare the fare can be increased or the income can be increased by means of a charge for transfers. Since the company has some outlying roads to which the 3 cent rate does not apply and the fact that cash passengers pay 5 cents unless they happen to have the exact change ready, the actual average fare now collected is 3.24 cents. At present the operation is experimental at this rate, and the rate may have to be raised still higher, and I understand that it has recently been decided to charge 1 cent for a transfer in addition to the initial fare. It is possible to operate on a low fare in Cleveland because the agreed capitalization is very low. The plan is, in my opinion, an experimental one. If it succeeds it should be remembered that the citizens of Cleveland are getting and will continue to get only such service as a 3-cent fare or a 3.24-cent fare or a 3-cent fare plus 1 cent for a transfer will yield. They will never get a 5-cent service for a 3-cent fare.

#### Best Solution So Far

The recently adopted Kansas City arrangement is a modified Chicago plan in which the "oversights" which I have mentioned have been eliminated. In Kansas City the railway was operating under a receivership. The citizens were rabid in their antagonism to the railway, as they believed that they had been misused. They felt that the system was overcapitalized, so much so that one of the leading papers of the city stated that the property was worth not more than \$14,000,000, although, to be fair to it, this was before an actual valuation showed it to be worth much more. In fact, the company had vouchers to show that \$35,000,000 had actually been spent upon the property. Under the settlement the company is to be allowed to earn 6 per cent. on \$30,000,000, and all surplus above this is to be invested in an amortization fund to be used in gradually retiring the intangible value of the property. The tangible property, as shown by my valuation, is actually worth more than \$21,000,000 to-day so that the amount to be amortized is about \$14,000,000. This is a fundamentally sound proposition for, if the railway is finally acquired by the city, it will be purchased for what it is actually worth, or if the property is continued under private ownership and management, the rate of fare can be adjusted on a basis of paying a fair return on real value where the intangible value has been amortized.

In conclusion I would say that while I think that Kansas City has the best solution of the partnership arrangement so far worked out, the Chicago plan has worked very smoothly for seven years. Of course we have had differences of opinion in Chicago from time to time as to the wisdom of the board's judgment on one point or another, but these have thus far been easily adjusted. Chicago has watched with pride the growth of the city's fund, now amounting to about \$14,000,000, and the citizens as a whole seem not displeased that the railways have earned 7 per cent. While I personally believe that the \$14,000,000 fund should be used as an amortization fund so that in time, after the intangible value has been eliminated, the patron of the street car will not be paying a higher price than it costs to render the service he receives, nevertheless the Chicago arrangement taken as a whole can be considered sound and successful.

### The Fight in Toledo

The electric railway situation in Toledo has taken another very interesting turn. It will be remembered that, following the expiration of the company's franchise, the City Council passed an ordinance fixing the regular fare at three cents. This amount the company refused to accept, claiming that the system could not be operated for less than a five cent fare. This deadlock has been maintained for several weeks, the conductors being instructed to collect the full five cent fare or nothing; in consequence, a large percentage of the citizens of Toledo, backed by the city ordinance, has been riding free. The matter was finally brought by the company before Federal Judge Killits, whose finding is that the city ordinance is unreasonable, unfair, and confiscatory. Judge Killits even goes so far as to declare that the original order was given with full knowledge that such a rate was not sufficient to even meet operating expenses, and that the city executive were "possessed of statistical information in most illuminating detail from the city's trusted expert, which, properly considered, showed that a three cent fare was confiscatory." The city solicitor stated that the original administration was fully apprised of the impracticability of the measure, and spoke of the political trickery that fathered it. As the matter now stands the city is enjoined from enforcing its ordinance for the three cent fare, which presumably leaves the way open for further franchise negotiations. In the meantime, the company have established the following schedule of rates: Cash fare, five cents; tickets good at all hours, six for twenty-five cents; tickets good only between 5.30 a.m. and 7.30 a.m., and between 4.30 p.m. and 6.30 p.m., five for fifteen cents or three cents each; children eight years old or under, one cent; children in arms, free. Apparently the citizens of Toledo are accepting the new rates as fair and reasonable.

### Electric Railway Publicity

The Twin City Rapid Transit Company operating in and around the cities of St. Paul and Minneapolis is recognized all over Canada, both on and off the stock market, as one of the best constructed, maintained and managed electric railway systems in the world. For this reason the following brief article on its publicity system, reprinted from the *Electric Railway Journal*, will be read with particular interest:—

"The publicity work of the 'Twin City Lines' is in the hands of A. W. Warnock, general passenger agent, who believes that 'making the public your friend is a fine art, and like most arts, it is an extremely simply one, once you know how.' Mr. Warnock's experience shows that friendly public sentiment can be developed through the giving out of accurate information on such subjects as 'Why Present Rates of Fare Are Not Unreasonable,' 'How the Electric Railway System is Operated,' etc. In reaching the general public the company has found the best mediums are the daily and weekly newspapers, window cards in the cars, folders and time-tables.

The company uses a great deal of advertising space in the local newspapers, utilizing such space liberally whenever there is any important announcement to be made, such as changes in schedules or any other matter which requires the co-operation of the public. In the news columns the company makes no attempt to play up new construction or development work, feeling that the papers are somewhat chary of printing matters of this sort. Mr. Warnock is, however, always ready to co-operate with the newspapers in getting up stories, and the company is on the friendliest relations with all of the local papers.

Window cards in the cars are found to be very effective means for reaching the public. The endeavor is made in these to teach some lesson of importance in promoting effi-



cient transportation. Among the titles of these cards may be mentioned "Please Read Your Transfer," "Suggestion to Passengers," "For the Comfort of Passengers," "For Better Service," "Regarding Small Children," etc.

The "Twin City Lines," to an unusual extent, makes use of folders and time-tables, advertising particularly its steamboat line on Lake Minnetonka, the White Bear Lake Resorts, Minnesota State Prison, and points on the Stillwater line. In getting up this printed matter the underlying motive has been to produce something of a very high class, in the belief that cheap printed matter is not acceptable to the public and does not hit the mark. Handsome folders like one recently issued under the title, "The Twin Cities—1914," are highly prized by the public, and local publicity organizations of a civic nature are glad to send these out to people inquiring as to the merits of the "Twin Cities" as a permanent residence. The 1914 folder was the ninth annual publication. Of the folders just mentioned 52,000 copies were printed this year, and time-tables giving information regarding the Lake Minnetonka and Stillwater lines have been printed in editions of 35,000 to 50,000 copies each. A local company distributes these folders in all hotels, ticket offices and folder racks, and the steam railways use quantities for distribution to prospective tourists. For a period of five weeks at the beginning of the season the company advertised that this folder would be sent to any address on receipt of 6 cents in stamps. From this advertising an average of nearly a hundred inquiries a day were received from people who expressed an intention of spending a day, a week or longer in the twin cities. The steamships on the Great Lakes, from Buffalo to Duluth, are also supplied with these folders, and tourists destined for Minneapolis are given copies. The same holds true on the Mississippi River steamboats.

In reaching its own employees the company uses no regular publication, but prepares small bulletins occasionally which can be handed to the men with their pay checks. The bulletin boards posted in the clubrooms are also useful for this purpose.

To quote Mr. Warnock in a recently published statement: "I hardly agree with the sweeping statement that the public is always unreasonable. It is our experience that the average public is a pretty decent public. Perhaps, who knows, what unfriendly feelings the public may entertain toward us may be largely our own fault. Don't we usually get what we give in all other relations of life? Maybe the same principle obtains in this matter."

#### New Motorman's Air Brake Valve

A new motorman's air brake valve, type "S" form "J," made by the Canadian General Electric Company, weighs only 10 lbs., is simple in construction and will, it is claimed, reduce valve maintenance to a minimum. The principal parts are the valve body, bonnet, valve stem and rotary valve. The rotary valve operates on a raised seat which is formed on the upper surface of the valve body. The ports, which are located in the seat, are drilled accurately to size and position. The location of these parts is arranged to perfectly balance the rotary valve, and to reduce wear to a minimum. The wearing surface of the rotary valve is provided with ports machined accurately to size and position. These ports register with the ports in the valve seat when the handle is in the different positions. An oil well is formed on the upper side of the rotary valve—this oil well being directly below the oil hole in the valve bonnet. A small port is drilled from the oil well to a groove machined in the lower surface of the valve and serves to distribute the oil over the wearing surface. The valve stem is of steel, case hardened, and is provided at the base with a leather gasket having a

broad wearing surface to prevent leakage between the stem and bonnet. The valve bonnet is provided with a bushing of composition material which serves as a bearing for the valve stem and can be removed when worn.

The surface of the valve quadrant which is machined to indicate the different operating positions of the valve handle, is case hardened to prevent wear from the movement of the



New air brake valve.

valve handle. The valve bonnet is provided with a case hardened wearing pad which relieves the stem of strains due to motorman leaning on the valve handle, and also reduces wear between the stem and handle to a minimum.

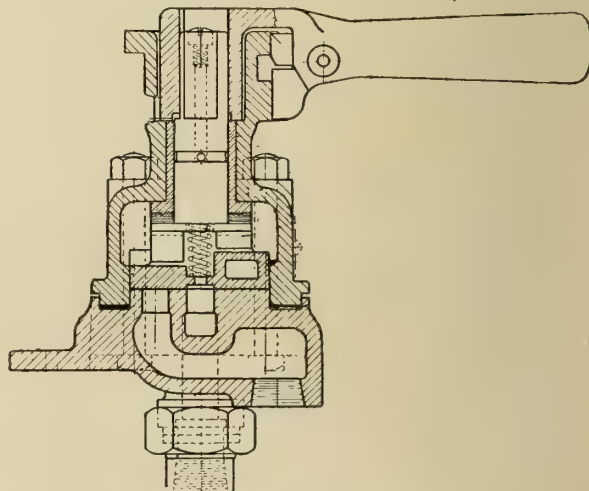
The following are the positions and functions performed by the valve when moving the handle from the extreme left to the extreme right position:

**Release Position:** Direct connection is made between the train line and exhaust through a large port.

**Restricted Release and Running Position.**—Train line is connected to exhaust through a restricted port in order to give a graduated release of the brakes.

**Lap Position:** All ports are blanked. This is the only position in which the handle can be removed.

**Service Application Position:** Connection is made be-



Showing interior construction of valve.

tween the main reservoir and train line through a port of such size as to give a prompt application of the brakes.

**Emergency Position:** The valve handle is at the extreme right and a large port is opened from the main reservoir to a train line in order to give a quick application of the brakes in case of an emergency.



# Illumination

## An Exceptionally Well-Lighted Railroad Shop

The manifold advantages of having adequate illumination in an industrial plant are being realized by no class of operators more readily than the far-seeing railroad men. Not only does the proper illumination of a shop mean a better and more efficient class of work turned out, but exhaustive tests recently made in a large industrial plant proved conclusively that a workman actually made a gain of several minutes per day in the production of a given piece of work, owing entirely to the better illumination with which he was supplied. These few minutes when multiplied by a large number of workmen amount to a considerable item.

There are shown herewith some views of an excellently lighted boiler and erection shop of a prominent eastern railroad. As will be noted, the illumination is abundant but entirely without glare or shadows, reaching every part of the shop. The buildings are 528 feet long and 58 feet wide, giving an area of 30,624 square feet in each building. The illumination for these buildings is furnished by type Z Cooper-Hewitt quartz lamps operating in a 220-volt direct-current circuit. This lamp is a modification of the well-known Cooper-Hewitt lamp based on the same fundamental prin-

ing an average space lighted by each lamp of 2,552 feet. All the lamps are hung at a height of 50 feet above the floor. The lamps are rated at 2,400 candle-power with an energy consumption of 725 wats, or a total for the installation of approximately 16 kilowatts. The light afforded by these lamps is entirely sufficient for all purposes even the loco-



Workmen save time with good lighting.



Properly lighted erection shop.

ciples, but possessing some essential differences. The details of construction have been described in the trade technical press. The lamp uses mercury vapor and a short tube of pure fused quartz instead of the long tube of lead glass used in the older types. Ten lamps are installed in the boiler shop placed at regular intervals of 52 feet down the middle of the building, each lamp lighting an average of 3,062 feet. In the erecting shop there are twelve lamps regularly spaced down the middle of the building at intervals of 44 feet, giv-

ing an average space lighted by each lamp of 2,552 feet. The only other form of artificial light required is a portable hand lamp needed by the workman when he goes inside the boiler. The total lumens per lamp from these units is 14,603, with a total available in a zone of 0 to 60 degrees of 10,800 lumens per lamp which, with a wattage of 725 gives a value of 20.2 total lumens per watt, and 14.9 available lumens per watt.

The efficiency of the system as installed is made evident from the low wattage consumption obtained per square foot, those being .28 for the erecting shop and .24 for the boiler shop, the former being claimed to be the best lighted erecting shops in the country. The average candle feet obtained is 4.24 for the erecting shop and 3.53 for the boiler shop.

No better evidence of the success of the installation from a practical viewpoint can be secured than the universal commendation of the employees who are working under the light. They are universally pleased with it and the results they are able to obtain. It is interesting to note, however, that when a trial installation of four lamps was first made, there was a certain antipathy to the light on the part of the men employed, because of the difference in color value, but this speedily disappeared after they gave it a thorough trial. This trial resulted in the adoption of the complete installation of these units. The lamps have been installed at various times but the entire installation averages practically 16 months and the



maintenance charges for the period totals \$134.54 or \$4.58 per lamp per year.

### Industrial Reflectors for 750 and 1000 watt Lamps

Three new types of reflectors for industrial service in connection with the new 750 and 1,000 watt mazda lamps are offered by the Holophane section of the Canadian General Electric Company. Of these Fig. 1 is a deep bowl steel reflector 15 inches in diameter, finished with porcelain enamel, white on the inside, and green outside. It is fitted with a  $3\frac{3}{4}$ -inch B-type heel for use with the holders described below. This unit is very efficient in directing the light downward, a high percentage of the emitted light being in



Fig. 1

the zone from zero to sixty degrees. The distribution is characteristically extensive. The angle of cut-off is fairly low—about twenty degrees below the horizontal.

Fig. 2 is a shallow dome steel reflector, 20 inches in diameter, with porcelain enamel finish designed to give the correct filament location with these large lamps;  $3\frac{3}{4}$ -inch B-type is provided. The angle of cut-off is about fifteen degrees below the horizontal. The candle-power distribution curve produced by this unit is widely distributing. Both of these re-

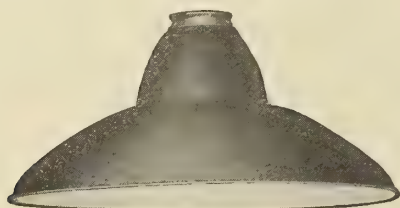


Fig. 2

flectors are of use in lighting any large manufacturing area where the ceiling is high and the lamps can be hung well out of the angles of ordinary vision. On account of its greater angle of cut-off, the bowl type may be hung somewhat lower than the shallow dome. In foundries or erecting bays, these may be located above the crane travel so spaced as to give even illumination on the working plane.

Fig. 3, is a bowl shaped metal reflector, 15 inches in

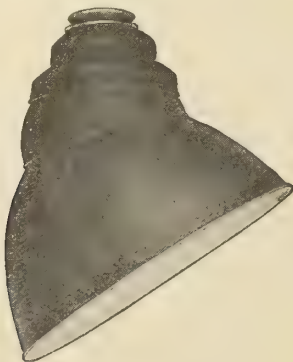


Fig. 3

diameter, with the holder set at an angle. The unit has the standard porcelain enamel finish and is fitted with a  $3\frac{3}{4}$ -inch B-type heel. It is constructed to give maximum candle-power at angles of from thirty to forty-five degrees from

the vertical. The equipment is useful for lighting large bays where it is desirable to locate the lamps at the sides, below the crane travel.

### New Shade Holders, Receptacles and Covers

A new line of shade holders, receptacles and covers for outlet boxes has just been put on the market by the National X-Ray Reflector Company, 235 W. Jackson Boulevard, Chicago. The shade holders are made of stamped steel and are remarkably rigid and substantial. The holder is secured



Fig. 1

in place by two screws which thread into the box cover, and serve to keep the porcelain receptacle in position. Three types of holders are available,  $2\frac{1}{4}$ -in. form "O,"  $2\frac{1}{4}$ -in. form "H,"  $3\frac{1}{4}$ -in. form "A." Receptacles can be supplied with either sealed terminals or clamping terminals. The box covers in 3-in. and 4-in. sizes are punched and tapped especially for the X-Ray receptacles. Covers, receptacles and hold-

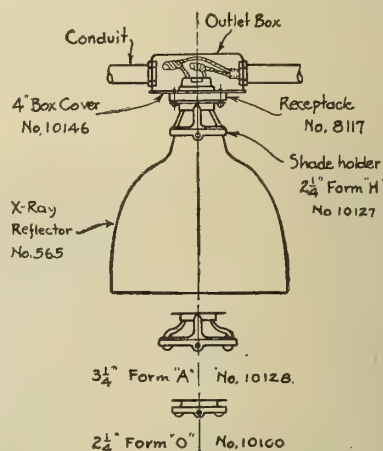


Fig. 2

ers have been designed as a unit, and assure the correct relation of lamps and reflectors. It is possible with a reflector and various combinations of box covers, holders and receptacles to make up a complete lighting unit to cover any outlet box. Figures herewith illustrate the new devices and show how easily they may be installed.

Illustrations in the current issue of "Telephone Talk" show interior departments of the plant headquarters of the B. C. Telephone Company, and several articles deal with plant matters. One sets out what has been accomplished by the company in the construction of outside plant and the installation of interior equipment, until today the telephone system of British Columbia is in excellent condition. Announcement is made also of the opening of two new exchanges at Colquitz, Vancouver Island, and at West Vancouver, making a total of forty-one exchanges now operated by the company in the province. Continuous service is given at all points, every telephone owned by the company being available at any hour of the day or night.



# Store Window Decorating and Lighting

The Value of the Window in Drawing Trade—Must Distinguish “Over” Decoration from “Effective”—Criticisms and Suggestions for a Number of Typical Locations

By Mr. E. N. Hyde\*

When the shoe merchant or his competent assistant glances at a pair of shoes in a competitor's store, he very frequently can tell at a glance the quality of the shoe, the price it cost the merchant, the retail price to the user and the consequent gross profit. His mental calculation does not stop there, however. He sees the something further in the last. Either it is extreme here or there, or it lacks certain lines needed to make it a good seller, or it is designed to look well at the expense of comfort, or it has in its proportions something, which with a few is popular and with many undesired, or vice versa—and he knows too that it will sell better in some parts of the city than in his own store. In other words, he sees the shoe as a commercial possibility.

When a person in need of a pair of shoes walks along a street he looks in the shoe shop window for ideas of latest styles, latest colors in light leathers, such as tans, and he imagines he can see his foot as it would appear in this or that or another shoe exhibited. The price interests him and he looks for the tag on a certain shoe which appeals to him most strongly. Thus attracted by the shop window samples he steps inside and it is only once out of a dozen or

night, when more than ever people nowadays do their buying, those shop windows must be lighted so that their attractiveness at 9 p.m. is no less than at 12 o'clock noon. A lighted window to be right must aid the eye in taking in every detail and bring clearly into vision of each one who looks all the characteristics of the lines on view, or else the merchant's acumen in



Window No. 1—Little to criticize.

more times that he comes away without purchasing. He has in this act done three things without being very conscious of any of them. First, he has confirmed the merchant's commercial acumen in the choice of his lasts, styles, colors, etc., as first mentioned. Secondly, he has secured what he wanted or had in mind when he started out, and thirdly, he has succumbed to the silent selling power of the shop window, which was the magnet that drew him into the store. It is this magnetic power of the window at night that forms the theme of this article. If there was no way of lighting it, its hours of usefulness would be those before daylight failed. To do the same service at



Window No. 2—Attractively dressed.

choosing his lines is not reaping its fullest reward, and the skill in dressing the window is wasted. To one who knows, the number of defects that exist in lighting shop windows of all kinds is appalling. The good window is not hard to obtain when a few fundamentals are considered and observed, and neither is a technical explanation necessary to make the essentials fully comprehended. There is, however, a woeful lack of understanding of just what happens to the light given off by light sources when surrounded by different light redirecting media and what follows is presented to our readers in hope that they will not permit themselves to be victimized by faulty designs in appliances used or incorrectly designed systems of lighting. To better illustrate six photographic reproductions of windows are given and the good and bad features of their lighting systems pointed out with suggestions as to how to correct some of the faults where they exist. The photographs were taken with this in view and because they represent typical cases most frequently encountered. Before discussing the photographs, however, a few general details for consideration are outlined.

Conspicuousness: The objects to be sold must in

\* Illuminating Department Northern Electric Company, Limited.



all cases be the most conspicuous and attention-attracting objects that meet the eye. This must be construed to mean that shoes must not be less conspicuous but must be more conspicuous than anything else in the window, if it is a shoe shop window.

Comfort: When the glance falls on the shoes the eye must not be offended by any discomforting sen-



Window No. 3—Lettered sign a clever device.

sation, but on the other hand, must receive a sensation that is agreeable to the owner, so that the longer he gazes the more pleasing are his sensations.

Contrast: A clear distinct outline of the shoes must be observed so that their proportions are unmistakably defined. Their colors must show distinctly and definitely when compared with each other. The background must set off the first, the trimming on which the shoes rest must accomplish the last.

Quantity of Light: The window must be bright inside. A quantity of light is needed to make it very much brighter than the outside lighting due to signs, street lights, ornamental standards, or neighboring windows. The contrast varies with the number of lights or their size, depending on surroundings.

Window Construction: Dimension, shape, height, colors of woodwork, etc., forming the background, the presence or absence of a "false ceiling," the presence or absence of a transom of translucent or other kind of glass above the false ceiling, and the depth with its consequent floor area, and lastly but of great importance, the presence or absence of a sash of clear glass or mirror at the back or store side of the window. Depending on these simple observations one has ammunition to get the best results.

Equipment: The reflecting devices which can be used or which are used must depend on the kind of window, but they are simple of classification. Let us analyze window No. 1. This is a well-lighted window that was no harder to illuminate properly than are many.

#### Window No. 1

- Feature 1—Has a false ceiling.  
 " 2—Has a glass transom above false ceiling.  
 " 3—Is very shallow.  
 " 4—Has light wood trimming in oak.  
 " 5—Has no wood shelves projecting to intercept light falling from overhead.  
 " 6—Recedes from the sidewalk and has little light from nearby sources falling on it.  
 " 7—Height of false ceiling not over 7 ft. above floor of window.

#### Present Equipment:—

- 1—Glass prismatic reflectors placed over round holes cut on false ceiling. The prismatic reflectors let light through to illuminate glass transom (Note—opaque reflectors would not have accomplished this lighting in two directions).
- 2—Window being shallow a wide band at the top translucent at night cuts view of lamps and reflectors out of range of vision thereby avoiding glare. Splendid feature.
- 3—Transparent band provided with letters giving the trade mark a clear expression to people on opposite side of the street. Splendid feature.
- 4—Has small lamps using comparatively little current as larger ones are not needed (see feature 6 above). So window is bright by contrast and



Window No. 4—Badly illuminated.

is not over illuminated, with consequent low cost for lighting.

- 5—Wood background not highly polished or varnished does not reflect the light sources or blur the image of the shoes.
- 6—Windows being very shallow, to keep the light sent out by reflectors within, these reflectors should be concentrating. Those in use distributing. This is the only defect in the whole scheme, and in view of results is a minor one.

Advantages to be noted:—Shoes are clearly defined. Little glare, from direct or reflected image of



light source, in range of vision to cause the observer to squint or feel uncomfortable or to tire the eye as it looks and sees each shoe and its color by reflected light aided by sharp contrast.

#### Window No. 2

- Feature 1—Ceiling high.  
 " 2—No false ceiling.  
 " 3—No transom.  
 " 4—Has light wood trimming.  
 " 5—Has no wood shelves projecting to intercept light falling from above.  
 " 6—Recedes from the sidewalk.  
 " 7—Has large exposure paralleling street.  
 " 8—Has lots of light from surroundings, making outside illumination very high.  
 " 9—Has sub show case on level with pavement.  
 " 10—Is comparatively deep.  
 " 11—Has low background arrangement above which are glass paned window sashes, perfectly transparent, obviously to let light into the store room.

#### Present equipment:—

- 1—Has two-light opaque mirrored reflectors of the trough pattern, wide of mouth. Set at intervals and close to plate glass window front, visible from street.
- 2—Lamps comparatively small and consequently quantity of light not great.
- 3—Contrasted with outside high illumination, window not very bright.
- 4—Reflectors designed to keep the light in the window not on the sidewalk. Splendid feature.
- 5—Clear image of reflectors seen in glass of back sashes, contributing glare.
- 6—Sub show case properly lighted, no light sources being seen and shows showing clearly and brightly. Could not be improved upon.

#### Suggestions for Improvements:—

Reflectors are of wrong type, should be opaque; mirror very deep—(X-Ray Helmet suitable).

Lamp should be 100 watt size but only one used where two are now to bring up illumination so as to better outshine the illumination of the sidewalk.

Some very flimsy silk—fabric white in color should be draped over back window sash to shut out reflection of the light sources whose images and their glare effect would disappear. This draping permits daylight to enter store much the same as before.

A silk or appropriate drape not more than 18 inches deep should be stretched at top of window inside so as to intercept view of "helmets." This would improve appearance as now seen with "poke bonnets" which instead of helmets are being used.

With these changes the writer can think of no criticisms that could be offered. As it is the window gives a fair appearance and is very attractively and tastefully dressed.

#### Window No. 3

- Feature 1—Ceiling fairly high.  
 " 2—False ceiling.  
 " 3—No transom above false ceiling.  
 " 4—Wood trimmed—finished white.  
 " 5—Has no wood shelves to intercept light falling from above.  
 " 6—Recedes from sidewalk.  
 " 7—Medium depth.  
 " 8—Has white background (not polished) running from bottom to top.

" 9—Surroundings fairly bright in vicinity.  
 Present equipment:—

- 1.—Cased 7-in. green outside, white within glass reflectors, set over holes cut in false ceiling.
- 2—Broad band, translucent with trade mark as in window No. 1. Same effect.
- 3—Lamps small in size—but plenty large enough due to
- 4—Low absorption of white background.

#### Suggestions:—

System of lighting all right.

A reduction of large white area inside with some relieving tone in panels would give warmth now lack-



Window No. 5—Good for certain localities.

ing. Otherwise a fine window. The lettered sign is a clever device, the reading of which can be changed at will, and calls attention to the latest in fall footwear.

#### Window No. 4

- Feature 1—Glass mirror, panel ceiling.  
 " 2—Bare lamps protruding from centre of each panel (12-in. x 12-in. approx.)  
 " 3—Mirrors for background.  
 " 4—Large exposure parallel to street.  
 " 5—Medium depth, exaggerated by mirror.  
 " 6—Surroundings not overly bright on near side, opposite side yellow flame arcs.

#### Present equipment:—

- 1—Lamps as above described set in mirror panels.
- 2—No other reflectors.
- 3—No translucent band.
- 4—Every lamp filament in plain sight, each lamp making a bright spot more conspicuous than any shoe in the window.

#### Suggestions for improvement:—

This window is wholly wrong from a good lighting standpoint. The glare of the lamps attract and offend, and take attention from the shoes. The eye is quickly fatigued and seeks relief elsewhere. The flat mirrors in the ceiling besides exaggerating the glare, by reason of their regular or specular reflecting properties, and because they are perfectly flat, send, or permit, as much or more light to pass out of the window on to the street as on to the shoes beneath them. The mirrors below reflect the back of the heels and when the shoes are tilted toe downward reflect the



soles besides destroying clearness in outlines and confusing shapes.

To permanently improve, rip out the whole equipment and follow scheme No. 2 and suggested additions to No. 2 in the way of draperies.

To temporarily improve, drape with white the lower



Window No. 6—Good at all points.

mirrors and curtain windows at top with at least 18-in. deep opaque curtains.

#### Window No. 5

- Feature 1—Ceiling moderately high.
- " 2—No false ceiling.
- " 3—No transom.
- " 4—No translucent band.
- " 5—Background obscure.
- " 6—Front parallels pavement.
- " 7—Side right angles to front.
- " 8—Moderately deep.
- " 9—No sash on store side.
- " 10—Flame arc outside.

#### Present equipment:—

- 1—Pendent glass reflectors.
- 2—Lamps for which reflectors are not designed.
- 3—Lamps very large size, filament all in range of vision.
- 4—Window piled with shoes tight against the plate glass.

#### Comment:—

The suggestions for improving this window are made on the basis of the proprietor's idea of what constitutes a successful show shop-window. Commercial success depends on knowing the people in the vicinity of your store. They may have no idea of the style or fashion in shoes. They buy only because necessity compels them to part with money for something that will protect their feet. The long wearing quality and the strength to resist rough usage are the features most desired by this class of buyer, who is likely to be impressed by the size of the stock, its mechanical construction of durability, and the apparent show and brilliancy of the shop window—and store, more than anything else. The proprietor of Shop Window No. 5 has made his window display to attract this class of buyer. From the standpoint of illuminating engineering the window is a failure. As a means of getting customers for the goods sold within, the window is a success. Thus psychology plays its important part in the

affairs of all and sets aside the best meant schemes of scientific preparation.

Suggestions:—There is no perspective to a window piled to the front until the soles of boots and shoes heaped promiscuously, press against the plate glass front; also boots and shoes being opaque do not let the light within the window pass through the heap. The only way to show the jumble is by an outside light. Hence the flame arc is good for the purpose.

The lamps within the window are put in reflectors for which they were never intended and boldly glare in every person's eyes, but they make the window bright. They should be covered with reflectors designed for them, and the vacuum lamps could be replaced with a fewer number of nitrogen filled lamps which would still more greatly increase the over-brilliancy of the window.

The flame arc lamp outside, hung low as it is—is certainly to be condemned as a disagreeable source of glare for all persons passing on both sides of the street, but it is the great illuminant needed to show off the heaped shoes within the window. To eliminate the glare and to still further illuminate the shoes pressing against the glass front, a shade reflector which would intercept all light radiating from the lamp up and down the street or backwards to the opposite side of the street, should be put around the lamp and the rays thus intercepted redirected to the shoe shop front, which would be much more highly illuminated than it is now. The spot where the store is located would be more conspicuous by far than it is now, to anyone riding or passing along the thoroughfare where it is located.

#### Window No. 6

This window is next mentioned because it is in such contrast to window No. 5. Everything within is shown

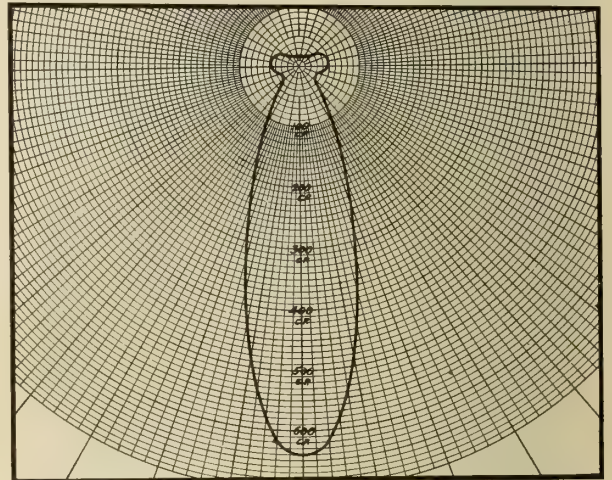


Fig. 7—Showing great concentration of light by special reflector.

to appeal to good taste and elegance, and each sample has a distinctive feature to be clearly revealed:—

- Feature 1—Window high.
- " 2—No false ceiling.
- " 3—No transom above false ceiling.
- " 4—Is very deep.
- " 5—Trimings—rather light in hue.
- " 6—Wide space parallel to sidewalk.
- " 7—No obstruction to light distribution by shelves.
- " 8—Outside lighting rather high but not glaring.
- " 9—Ornamental post standards give char-



acter to the store location and having large diameter globes the effect is not offensive from standpoint of glare, but on the other hand attention attracting and conspicuous.

#### Equipment:—

Prismatic glass reflectors suspended from ceiling.

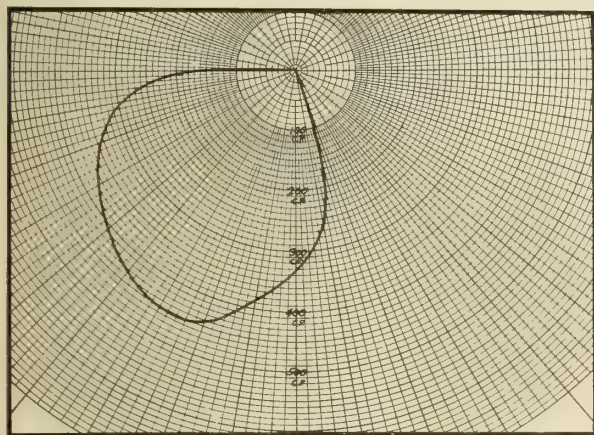


Fig. 8—Poke bonnet reflector directs the light where most required.

Windows furnished with curtains controlled from inside.

Wood Arches:—increasing perspective.

#### Suggestions:—

Window fine. Higher intensity to increase contrast with outside lighting desirable. Concentrating reflectors instead of distributing now installed, would do this without increasing cost for current.

Window curtains on street exposure should be kept 18 inches below window top to cut light sources from view.

Heavier diffusing quality of glass balls on post standards, should be used so that no bright spot can be seen indicating the location of the lamp filaments. Aside from these minor changes the window is fine from all standpoints.

#### Types of Reflectors

Prismatic reflectors are used with greater frequency in show windows of all kinds than is any other type.

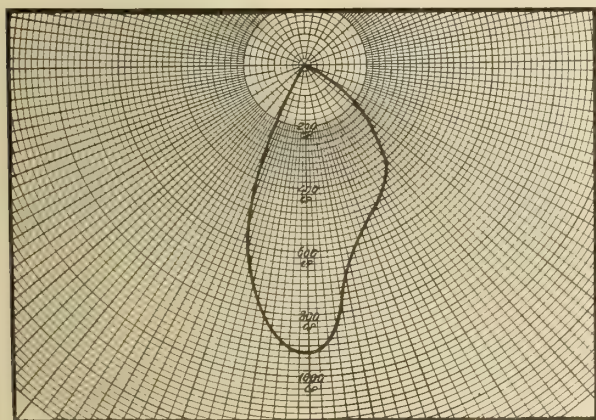


Fig. 9—Curve showing unsymmetrical distribution of light by helmet reflector.

They are made to give several degrees of concentration and Figure No. 7 shows a characteristic curve of extreme concentration. For shallow windows, or for high windows, these are suitable. They can be instal-

led with the receptacle placed close to the plate glass of the window and when necessary to throw the light high on the background they can be "staggered," that is to say, the lamp tip is made to point at the desired spot on the background, and the next lamp placed with the tip pointing to the floor of the window. If a transom is used as in Window No. 1, they have a decided advantage, in permitting about thirty per cent. of the available light to radiate above or in the "upper hemisphere," and lighting the transom, while the balance is concentrated below.

The Poke Bonnet is a convenient unit type A trough reflector. The characteristic curve given (Fig. 8) shows how it changes the direction taken by an ordinary lamp. It is opaque and gives no upper hemispherical light but is efficient. It is wide at the mouth and displays the lamp within. The view of the reflectors in Window No. 2 is wholly due to reflections. The poke bonnets were not in range, but their image in the clear glass, window sashes on the inside or store side of the window reflected them very clearly—as shown. Had the helmet reflector been used, this

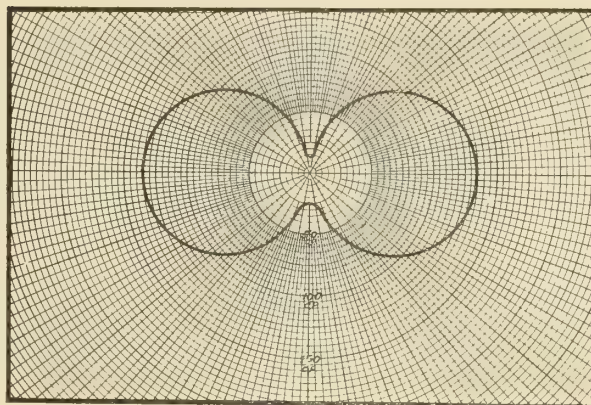


Fig. 10—Distribution of light using no reflector.

would not have been the case. The deep bowl shaped reflector gives wonderful concentration, besides sending the light towards the background. The uneven kind of distribution shown clearly in Fig. 9 is known as asymmetric. The units in all cases should be kept from view either by means of transparent band, or by drapery. If used where there is a transom to be lighted above the window, additional lights must be installed, just to light the transom. When making comparisons of the way light is directed by reflectors it is necessary to know how light radiates from a bare lamp. Fig. 10 gives the characteristic curve of a mazda lamp, with the drawn wire tungsten filament burning in vacuum.

In conclusion we suggest that each show window be regarded as a stage. The shoes as the conspicuous objects, the background as the background of the window, the lights concealed except for ornamentation, as are concealed the foot lights, the border lights and strip lights, which throw all their radiations to the stage without being in range of vision. The darkness of the auditorium accentuates the effect. The lowness of the outside illumination likewise makes the window look brighter by contrast. Special pains were taken by Mr. E. P. Wallace to photograph windows selected by the author and the skill with which the work was done deserves special mention and appreciation.



# *The Dealer and Contractor*

## **Electricity in Homes and Stores Vitrally Concerns the Electrical Contractor and the Central Station**

One of the principal things about which we are all concerned is the application of electricity to houses and to stores. One of the things that is being tried by our committee is an attempt to get some standardization in the matter of plugs and receptacles, and I want to read to you just an excerpt from a report by the Commercial Section Committee on Wiring Existing Buildings, on the subject of standardization of plugs and receptacles. It says:

"The question of standardizing plugs and receptacles was referred again to this committee, and the committee has discussed it thoroughly at its meetings and the chairman has had interviews with the underwriters and the manufacturers, but can only report progress and not too much of that.

"As pointed out in our last year's report there are two questions: First, the classification of plugs and receptacles into a large and a small size. At present nearly all plugs, with the exception of the ordinary screw plug, are good for more than six amperes, so that underwriters consider the installation of a receptacle which will take a plug that is good for more than six amperes as evidence that devices taking more than six amperes will be used on the circuit, and, therefore, the inspectors require such receptacle to be on a separate circuit and not on a lighting circuit. The result is that the wireman and owner install ordinary sockets on the lighting circuit even in places where receptacles would be better practice.

"In order to obviate this, last year's report suggested classification into large and small receptacles, of which the small size should be allowed on lighting circuits as freely as sockets, but no single manufacturer is ready to so classify his receptacles, because he knows the only result will be to limit the sale of his device, and up to the time of writing the underwriters have felt that they should rate a receptacle up to its safe limit.

"However, the chairman of the committee has had conferences with the underwriters, with a view to ascertaining if they would not consent, when the manufacturer asked them to limit a plug to a capacity of, say, six amperes or less, and agreed not to put it out as good for anything more than six amperes, that in these cases the underwriters would direct their inspectors to allow receptacles for such plugs to go freely on lighting circuits. If this can be done it will warrant some of the manufacturers in limiting their plugs to capacities that can be safely allowed on lighting circuits, and will then result in a receptacle for such plugs being more freely used on lighting circuits instead of using sockets for heating devices. Unfortunately the underwriters so far do not wish to take this action. We cannot believe that the underwriters prefer to see 600-watt devices used from sockets rather than from receptacles, but that is the result of their present rules and interpretations.

"As regards the actual standardization, so that all plugs

and receptacles in a given class should be interchangeable, here we run into the question of patents. The National Electric Light Association obviously cannot make any standard which is tied up to a patented article. The only hope would be to get the manufacturers together, and thus far this has proved impracticable. The only way would seem to be some sort of pool, and this would be difficult anyway, and probably repugnant to the laws against monopolies.

"Possibly the time may come when a plug and receptacle shall be made sufficiently good to warrant the Association in recommending it as a standard, and at the same time sufficiently free of patent restrictions so that this course will be proper.

"We can only report progress, and suggest that some committee of the Association should continue to watch the matter and do what is possible toward the desired end."

The question of standardization has been an exceedingly important one to the central station company. The fact of one or more appliances being sold on different types of plugs is repugnant to the user of electricity, and limits, to a large extent, their general application, and anything that this Association may do with reference to recommendations along lines of standardization for all plugs and receptacles will meet with hearty co-operation from the Commercial Section of the National Electric Light Association.

### **Plugs and Receptacles**

Now, from the question of standardization of plugs and receptacles I want to carry your mind a little bit to the actual co-operation as pointed out specifically in an example that I am going to speak to you about, between the central station and the contractor, as evidenced in Brooklyn. We have a scheme there whereby the top of the contractor's window is painted with the words, "Edison Light and Power Applications Received Here." Beneath that sign, which extends across the entire width of the window, and three feet deep, is the name of the contractor, with any additions he may want to make, such as "Wiring," or "Motors Installed." This window is lighted at our expense from dusk until midnight, and the contractor represents us in all his dealings.

There are twenty-six of such windows as I have described, belonging to contractors, in the Borough of Brooklyn.

Now, that is one specific method of co-operation, and I cite it to you as evidence that we have suggested a definite means of co-operation.

In addition to that window, we give the contractor what we call a "Contractor's Red-Book." This book, in effect, is a package of postal cards, and our customers go to the contractor nearest their location, if there is any complaint about the Edison service at that point. The contractor then writes us a postal, saying that he has a complaint from some particular customer, and will we look into it, and we reply to that contractor, giving the particulars of any complaint that may be made.

Now, I want to call your attention to a most important detail, and that is a class of customers which the central



station has not been able to get. This is the customer who pays a dollar, or less, per month. It is easy enough, as a general rule, to get an applicant to take current for his house where he has a fairly good sized house, and where he is going to pay from two to three or five dollars a month. Such customers are remunerative, but there are lots of customers in localities where there is no minimum guarantee per month, or, even where there is a minimum guarantee of a dollar a month, who burn from six cents to a dollar's worth of current a month, and which are absolutely unproductive. In the city of New York alone there are five thousand customers in apartments and houses, whose monthly bills are less than a dollar a month. According to the actual cost figures, under our present method of service (the cost of the cable to premises, the cost of the meter reading, the cost of the billing, the cost of the meter itself, and the cost of the lamps), no station can supply a customer and make a profit, whose income is less than a dollar a month.

The obvious question, therefore, is—How can we make that customer a productive customer? Now, the obvious answer to that is, Get rid of your fixed charge. And when you ask—what is the fixed charge? the reply is that the meter is one of your most expensive items, and lamps are another expensive item in the service of such customer. So ways have been thought out to get this customer, but with a reduced equipment. One way is to get rid of the meter. Suppose you go to the milkman and say, "I want a quart of milk left at my house every day for a month, for which I will contract to pay you seven or eight cents per quart." Suppose we could fix it so that the same method could be applied to the supplying of current and the customer should say, "I want you to supply me with a hundred watts of electricity delivered to my house continuously, for use any time I want it, and I will agree not to use more than a hundred watts. Can you sell current to me that way?" The answer is, "We believe we can." That is the method upon which we are working now—that is, to sell, in place of kilowatt hours, so many kilowatts of demand per month, and we will put on that installation simply a cut-out, which, when a man gets above a hundred watts, will flicker his light, or cut him off. Now, that customer can put into his house twenty-five, thirty, or as many lamps as he may desire, but he cannot use more than a hundred watts at a time. That is the method that they are pursuing in Milan, Italy, and in Germany, where they sell as low as thirty or forty cents worth of current per month.

#### Everybody Using Current

What is the result? We get all the poorer classes using current. Many of the negro plantations around New Orleans today are buying current on such a device, which here is called an excess indicator. You will say, "Of course, that is easy enough for the central station company to do that, but if it is so hard for you to get a dollar out of a man for the current, what are we fellows going to do about wiring the house?" That is an important item, and what we want you contractors to do is to get together and adopt, or get approved by the underwriters, as we have been trying to do, some cheap method of wiring, which will carry safely and will at the same time limit the expense.

Mr. Doane, who will speak to you to-morrow, will present to you samples of different types of wiring that are used abroad. Some of you will say that a great many of the conditions that are seen abroad could not be duplicated in this country, because the fire hazard here is too great, because most of our buildings are of wood, while abroad the majority of them are made of stone, or brick, or other non-inflammable material. But they have adopted abroad, as you will see from the material which Mr. Doane will show

you, some of those types of wiring which go with the limiting device.

The thing I want to point out to your attention especially is that so far as the central station is concerned, it is directing its energies toward getting the small consumer, who is now on a non-productive basis, up to a basis where he will give us a net profit.

From the question of the small consumer, naturally, one comes to the question of installment wiring. In Brooklyn and New York we have a slogan, "Wire your living rooms for forty-nine dollars." Immediately a contractor hears that, he goes away up in the air, and he says, "Why, it is absurd. We can't make any money at that rate," and we say, "We don't expect you to; we have no more idea of getting only forty-nine dollar customers than we have of getting thousand dollar customers, but you have to get bait first, to get your fish, and the forty-nine dollars is the bait." When we advertise, as we do, all throughout Brooklyn, "Wire your living rooms for forty-nine dollars," while we have a type of fixtures, and while we have a number of contractors who install this wiring for this figure—and they all do this—we don't do it ourselves—we do that for advertising purposes, and naturally expect larger customers and we get them. It will interest you to know that last year eighty-seven per cent. of all the inquiries that were attracted by the forty-nine dollar proposition, spent a hundred dollars or over in their wiring. This, I think you will agree, justifies the fact that the advertising value of the forty-nine dollar proposition was all we cared to bring out. So when you see central station companies advertising propositions which you contractors may consider absurdly low, don't judge it by the amount you see advertised, but by the thought which is back of the small figure.

#### First Catch the Eye

There are two things that you have to do before you get a man to be a customer. First, you have to get his eye—you create his interest; and then you instil the desire to buy. That forty-nine dollar figure creates his interest, and when he investigates how cheap that is, he goes a little further, and the desire to buy is the necessary follower of the interest that you have at first created. Take that forty-nine dollar proposition—even the figure nine has a great advertising value. You never saw a department store advertise anything at a dollar, or at fifty cents—it is always ninety-eight cents or forty-nine cents. It is always the odd cent, because that is the psychological thing that catches the eye, that creates the desire to buy.

Here are two pamphlets, one by the Union Gas and Electric Company, of Cincinnati, that goes quite to some length in describing their proposition. It says that the object of the campaign is to make it possible for the owner or occupant of any unwired home to enjoy electrical service. "We will equip your house with wiring and fixtures at the lowest possible cost."

In Brooklyn we attract the man with the forty-nine dollar proposition, and then, wherever that inquiry originates, we send our representative to the nearest electrical contractor to that location, and take him to the house, and he goes over what the applicant wants. The applicant tells the contractor what he wants done, and then we write an agreement for the customer, saying that he will authorize us to contract for his electrical wiring, and we have the contractor do the wiring just as the customer wants it done. Whenever wiring is done we pay the contractor in full, and the customer pays us in partial payments, with his monthly bills, as they come due.

Now, we have gone further than that in Brooklyn. We say to any contractor in Brooklyn, "If you have a reliable prospect, who can't afford to buy a motor, and he is a good



business risk, we will buy the motor for him from you." In other words, we will finance the purchase of that motor, the same way as we finance the wiring. That has worked out very satisfactorily. Of course, you must realize that we cannot put these motors in haphazard. The layout must be carefully studied; the engineering risks must be carefully worked out by those men who are experts in studying out such situations. The customer pays for the motor at the same time he pays for the current.

A number of the contractors have asked me whether the time is ever coming when contractors are going to supply lamps, and I have answered them, as I answer you: I don't think it is. I think a great many of the central stations would welcome the handling of lamps by others than themselves, but up to the present time that has not been feasibly arranged, and the results, where it has been tried, have not proved generally satisfactory. I don't know whether the personal element enters into it or not, but while one or two cities have handled it satisfactorily, others have not. Objectionable as it may be, the carrying of lamps by the central stations seems to be a necessary adjunct to the business.

Now, from the lamps I want to go to another part of the business, and that is the question of appliances. Appliances sold by the central station company are simply a means of advertising. When we organized our display room in Brooklyn, I had every contractor in Brooklyn understand what the plan of the Edison Company in Brooklyn was going to be, in the display of appliances. I said to them, as I say to you, that we are selling electrical appliances for advertising purposes; but we don't believe in giving appliances away for the sake of selling current.

#### Value of Special Sales

Now, we do believe in special sales at prices which will draw the trade. We have a special sale this month, of irons, at \$2.49. We have an attractive iron price from five manufacturers, and I had a committee of contractors in my office, and I said to them, "We are going to run, during the month of July, a sale of irons at \$2.49. We have a rate from five manufacturers, that will give us our regular profit on those irons. If any contractor in Brooklyn wants to sell the same iron at the same price we sell it, we will deliver the irons to him at our cost, plus five per cent. for handling." Now, what has been the result? Up to the present time—and I left Brooklyn day before yesterday—we have sold six hundred and fifty irons in our shop alone, and in addition, three hundred of the irons had been sold by twenty contractors throughout the Borough. I sincerely believe in special sales. They are not cut prices—they are introductory prices, which the manufacturer gives us, and which we give to the contractor as well as to ourselves. Furthermore, we say to the contractor, "You can take as many as you like; our stock room is yours, and if you have a call for five of the irons, you can get them in twenty-four hours, and not stock at all."

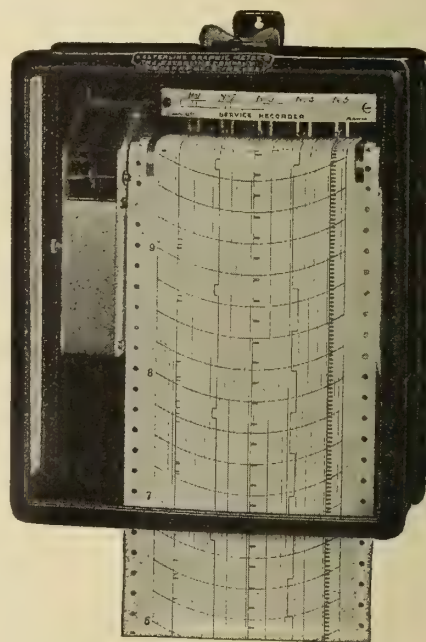
One company, a year ago, sold a four dollar toaster for \$2.00 retail, with a corresponding reduction in the cost of the article, and they advertised it in a leading magazine throughout the land, as a special day. We advertised it and the contractor advertised it, and what was the result? In one day we sold twelve hundred toasters. But that wasn't all. It wasn't only the twelve hundred toasters that we sold, that we cared so much about. That wasn't it. Four hundred of the twelve hundred customers who bought toasters bought something else. That, to my mind, is absolutely the essence of merchandising principles. The sooner contractors realize that if they are going to get along in their contracting business, they have to adopt merchandising methods to bring the people into their shops, the quicker they will succeed. It is not the iron that you sell—it is the fact that the custo-

mer comes into your store and asks about something else. That is the reason for the special sales on appliances.

Don't think, gentlemen, that you don't want to handle appliances because there is no money in them—there is not much money in it per sale. But every time you sell an appliance you create a desire of the customer to buy something else. If you go into a Regal shoe store and meet a clerk who has been properly instructed, after he sells you a pair of shoes, he will say, "Will you have a pair of shoe trees, or some polish?" He does not say that because he wants to, but because he has been so instructed. When a customer comes into your appliance show room to buy an appliance, your clerk should say "Have you a light on your porch?"—or, "Do you wash and iron electrically?"—leading the consumer along electrical development of his home. Then we wouldn't have so many locksmiths with the name of "electrician" attached to them.

#### New Service Recorders

Keen competition in the manufacturing business has encouraged the development of a number of instruments and devices intended to increase efficiency in machine tool operation. One of the most indispensable instruments of this type is known as the service recorder. A new instrument of



Service recording meter.

the service recorder type has recently been placed on the market. This meter operates on the same general principles as common graphic or curve drawing instruments. It is equipped with any number of pens desired from one to ten inclusive. Each of these pens is controlled electrically. The pens rest on a long strip of paper or record chart which is driven through the meter at a constant rate of speed by a high grade jewel balance wheel type eight day clock. The clock may be equipped with gears giving five paper speeds of  $\frac{3}{4}$ ,  $1\frac{1}{2}$ , 3, 6 or 12 inches per hour. An attachment can also be provided on this clock giving additional chart speeds of 45, 90, 180, 360 and 720 inches per hour. The clock is provided with stops so that its operation may be interrupted at any time. A regulator is furnished for adjusting the speed of the clock in service. Clocks are furnished with re-rolling device for winding up the finished record in the bottom of the case or this device may be omitted and the finished chart fed through a slot in the bottom of the cover, the record being torn off daily.

Record charts are supplied in rolls of 90 feet in length



and 6 inches in width. This record may be torn up in short lengths for convenience in filing. Perforations are provided along each margin of the chart which are engaged by pins on the clock driving roll insuring perfect alignment of the paper and accurate timing of the clock.

Each pen is so controlled that when a record is made a vertical line about one-eighth inch in length is drawn across the chart, the pen returning to the zero position after each record is made. The controlling devices for the various pens are connected to different machines in such a way that one record is produced for each operation or for a certain number of operations. On account of the paper travelling through the meter due to the clock, the resulting record is a series of short lines, the spacings of which represent the rate at which operations are being completed. If the machine is being operated up to capacity, the series of lines will be close together but if the machine stands idle for several minutes, a straight horizontal line will be drawn across the chart showing that no work was accomplished during this time.

The electrical control for the pens is very efficient and requires such a small amount of current that the power consumption is negligible. The instruments have high internal resistance and may be operated at any distance from the machines. One instrument may be located in the superintendent's or manager's office and operated by small wires connected to the machines located at various parts of the plant several thousand feet away. Any source of direct-current either storage battery, shop or trolley voltage may be used for operating the instrument.

On machines operating at a high rate of speed and completing a number of pieces or operations in a short period of time, it is advisable to gear the controlling device on the machine so that one line on the chart will represent 10, 100 or any other convenient number of operations. On account of the large possible number of chart speeds that may be obtained on this instrument, it is easily possible to get a suitable record on any class of work. If operations are completed at a slow rate, then the chart may be operated at a slow speed so as to shorten the record but if operations are a clearer record.

These instruments are also furnished with a counting attachment arranged in such a way that they total up the operations so that the total production for the day or period can be quickly determined direct from the recorders.

Service records are used for a variety of purposes in addition to machine tool recording. Each pen can be arranged to give a record of when motors or other machines are being operated and when idle. They are also used for traffic recording on steam, interurban and street railways. In this case, each pen is operated by trolley contacts and records the exact time of car passing a given point of the system.

This service recorder is manufactured by The Esterline Company, Indianapolis, Indiana. The general design of case, clock and other parts is identical with the standard line of curve drawing electrical measuring instruments manufactured by this company.

#### 75-Ampere Trailer Connector

A new 75-ampere trailer connector, shown in accompanying illustration, has just been placed on the market by the Electric Service Supplies Company. Its design is identical with that of the standard 10-ampere type originated by this company about five years ago. This new type is to meet the demand for a connector having sufficient capacity to supply current for both lights and heaters in the trailer. The safety features embodied in the 10-ampere type of Keystone trailer connector are all contained in this new type of greater capacity. They are so designed that when the con-

nectors are not in use the exposed metal parts are automatically disconnected, so absolutely eliminating any possible danger of shock to employees and passengers. The shells are of hard maple thoroughly impregnated with insulating material and waterproofed, so avoiding possible breakage which often occurs when hard rubber compositions are used. The connecting tongues are of heavy brass equipped with phos-

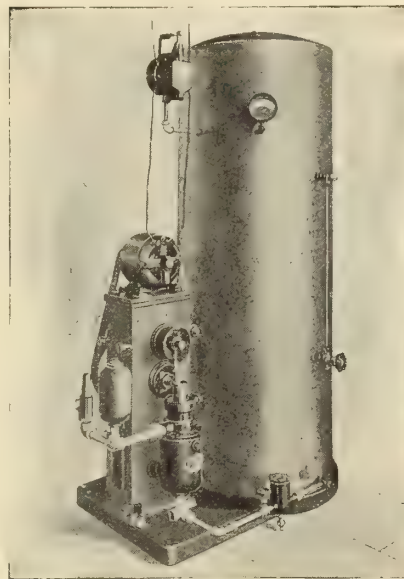


Trailer connector.

phor bronze retaining springs. Sockets for holding the connectors when they are not in service have been designed and are of either the same material as the shells of the connectors or of cast iron, black enamelled. In the cast iron socket no further insulation is necessary owing to the automatic disconnecting feature of all exposed parts.

#### The Paul Electric House Pump

A somewhat novel type of electric pump for residence use has been designed by the Ft. Wayne Engineering & Manufacturing Company, Fort Wayne, Ind. As shown in the illustration, the pump, pressure tank and all accessories are mounted on a bed plate forming a self-contained unit that requires only connection to the service pipes and lighting circuit to be ready for operation. The pump is driven by



Paul Electric House Pump.

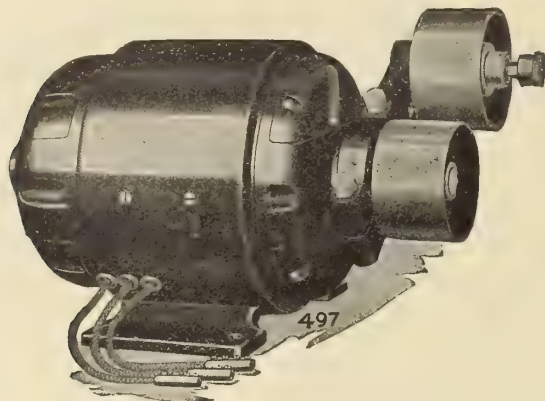
a small Westinghouse Electric motor, which is mounted above the floor from dirt and water, and is belted to a counter-shaft geared to the pump. The gears are enclosed within the cast iron stand on which the pump and motor are mounted. Included with the outfit are an automatic priming device, which insures a supply of compressed air inside the tank, and an automatic pressure controller which keeps the pressure within the tank adjusted from 30 lbs. minimum to 50 lbs. maximum. These pumps are furnished in sizes of 150 and 300 gallons per hour, with tanks of from 66 to 220 gallons capacity. The trade name is the Paul Electric House Pump.

The plant at Wasdell's Falls, constructed by the Hydro-Electric Power Commission of Ontario, was formally placed in operation on October 7th. This plant will supply Beaver-ton, Cannington and neighboring municipalities.



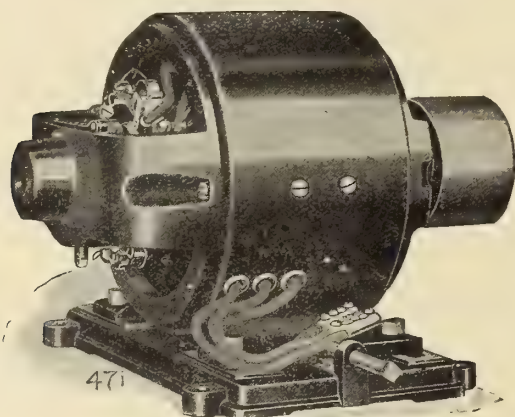
### New Steel-Frame D.C. Motor

The illustrations herewith show a new type of direct-current motor, just recently placed on the market by The Robbins & Myers Company, Springfield, O. These motors have cast steel frames and are specially adapted for any service where the space for installing the motors is restricted, or where light and compact construction is desirable for any



$\frac{1}{2}$  h.p., fully enclosed, with idler pulley attachment.

reason. These motors are the bi-polar type and are made in four frame sizes with outputs of  $\frac{1}{8}$ ,  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1,  $1\frac{1}{2}$  and 2 horse-power. They are supplied for operation on all standard voltages. The line includes open, fully-enclosed, semi-enclosed and grid type frames. The motors can also be supplied equipped with idler pulley attachments or back gears where this construction is desired. All standard outfits are



1 horse power, open type.

equipped with sliding bases, pulleys, and no-voltage release starters. The bearings are phosphor-bronze and are lubricated by oil rings. The pole pieces and armature core are built up of steel laminations. The armature coils are wound directly into the slots. The brush holders are mounted on an adjustable rocker and are the sliding box type.

### New Switch and Distribution Cabinet

The Detroit Fuse & Manufacturing Company have recently brought out a new line called the "Square D" Enclosed Entrance Switch and Distributing Cabinet. This new line is made in Canada and salesrooms have been established at 216 Wyandotte Street East, Windsor, Ont. Safety and simplicity of operation, the housing of all live metal parts, steel construction and reasonable price combine to make this one of the best lines of entrance switch on the market. The line, at present, consists of a single box, containing a double pole, 30 ampere 125 volt combination switch and cutout, for Edison plug fuses; a double compartment box in one side of which is mounted the same type of switch and cutout as in the single box and in the other side is mounted a two-wire,

double branch Edison plug cutout; also a double compartment box with a main line switch and cutout in one side and two two-wire double branch cutouts of the Edison plug type in the other side. These cabinets are substantially made of No. 16 Ga. steel, with corners electrically welded—the finish being baked-on black enamel. The partition in the double compartment boxes is of sheet steel also electrically welded. Convenient knockouts are provided together with ample space for wires and making connections, these features being especially noteworthy as regards the work of installing. An exclusive "locking off" device is furnished which effectually prevents operating the switch when placed in the "locked off" position. All cabinets are furnished with switches and cutouts mounted ready to install. The new line meets the latest requirements of the Hydro-Electric Power Commission of Ontario, and is approved by them. It is one of the results of the efforts of the Commission to render electrical installations non-hazardous, in which rapid strides are being made by the municipalities throughout the province.

### Let Electrical Contracts Separately

Some months ago the American Institute of Architects passed a resolution recommending the practice of letting contracts for mechanical equipments such as heating, plumbing and electrical work separate from the general contract. The resolution of the Institute was worded as follows:

"Resolved, That the American Institute of Architects, in convention assembled, recommends to the members of our profession the adoption of the practice of direct letting of contracts for mechanical equipments such as heating apparatus, plumbing and electrical equipment. This recommendation is based on the conviction that direct letting of contracts as compared with sub-letting through general contractors affords the architect more certain selection of competent contractors and more efficient control of execution of work, and thereby insures a higher standard of work and, at the same time, serves more equitably the financial interest of both owner and contractor."

At the recent convention of the National Electrical Contractors' Association, the course of the Institute of Architects was approved in the following resolution:

"Resolved, That the National Electrical Contractors' Association of the United States, in convention assembled, concurs in the resolution adopted by the American Institute of Architects last December, at New Orleans, covering the segregation of plumbing, heating and electrical equipments, from building contracts; and that a copy of this resolution be sent to the Secretary of the American Institute of Architects."

### A New Morris Crane

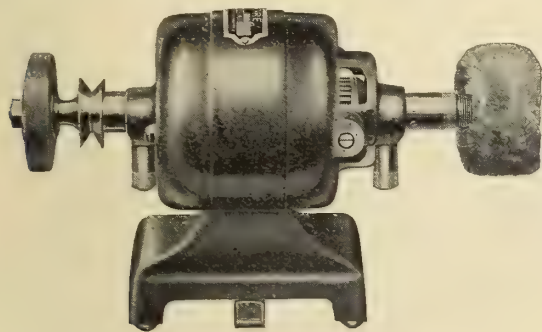
An interesting new standard overhead crane has been introduced to the Canadian market by the Herbert Morris Crane & Hoist Company, Limited, a description of which is embodied in bulletin B9. Instead of running on the top of a rail, as is usual in overhead travelling cranes, this type is designed to run on the lower flange of two parallel I-beams. These may be existing roof beams, or special beams simply attached to the roof trusses; hence, a reduction in first-cost made possible by the elimination of the usual brackets.

J. H. Tucker & Company, manufacturers of electric light and power accessories, Birmingham, announce that H. M. Office of Works has just placed a contract with them for the supply during the next three years of single pole and double pole 5 and 10 amp. tumbler switches, and also single pole 5 amp. two-way tumbler switches; these all to be of the company's well-known No. 20 positive action pattern. The switches are to be mounted on either white or black china bases, with fluted or plain brass, covers lined.



**One Quarter h.p. Universal Motor**

The illustration herewith represents type D  $\frac{1}{4}$  h.p. 110 volt universal Dumore motor for sale by the Canadian General Electric Company. This is a buffing motor that will run on any current, has good speed regulation and plenty of power, with which is also combined good workmanship



The Dumore Motor.

and attractive appearance. The motor is adapted for three speeds. It is finished in black enamel and equipped with emery wheel, buffer and pulley. This motor is especially designed for dentists and jewellers, but would also be extremely useful in hotels and restaurants.

W. H. Taylor, Limited, have incorporated as mechanical and electrical engineers and machinery manufacturers. Head office, Montreal; capital stock, \$50,000.

La Compagnie Hydraulique de Portneuf, Limitee, has been incorporated with capital stock of \$145,000 and head office at Saint Marc des Carrieres.

The Barnes & Kobert Manufacturing Company, pole line hardware and construction specialists, recently opened their new factory and office building in Milldale, Conn.

H. W. Knight & Bro., electric fixture manufacturers, of Toronto, announce the publication of their new catalogue on electric fixtures, which will be ready for distribution about October 15th. The catalogue, it is announced, covers a very wide range of designs.

**Trade Publications**

**D. C. Motors**—Bulletin 121, issued by the Robbins & Myers Company, describing and illustrating their type S steel frame direct current motors.

**Monorail trains**—Bulletin No. 48,700, issued by the Canadian General Electric Company, describing Sprague electric monorail trains, with illustrations.

**Circuit Breakers**—Pamphlet Y-487, issued by Canadian General Electric Company, Toronto, describing small capacity circuit breakers up to 300 amperes and up to 500 volts.

**Steam Engines**—Bulletin No. 128, issued by the Canadian Allis-Chalmers, Limited, Toronto, describing Chandler & Taylor steam engines built for direct connection to electric generators.

**Hospital Call System**—booklet issued by the Bryant Electric Company, Bridgeport, Conn., describing their silent call signal system for hospitals. This system is also adapted for service in hotels, offices, department stores, public buildings, etc.

**Electric Drive for Flour Mills**—booklet issued by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., describing and illustrating motors suitable

for flour mill work. The same company have also issued a folder describing electrically-heated glue pots and glue cookers; and leaflets describing motor generator sets and electric drive for rubber calenders.

**Electrical Equipment of Oil Wells**—Bulletin 48013, issued by Canadian General Electric Company, describes electrical equipment of a large number of wells and gives tables of actual comparative operating costs for a considerable range of conditions showing excellent results obtained.

**Curve Drawing Instruments**—Leaflet Y-494, issued by Canadian General Electric Company. The instruments may be operated on alternating or direct current. The electrical element is of the solenoid type, simple and direct acting with gravity control. There are no make and break contacts.

**Synchronous Converters**—Bulletin No. 42,500, issued by the Canadian General Electric Company, illustrating and describing synchronous converting machines. The same company have issued bulletin F—a folder on Wheeler multiple mazda fixtures; also a folder dealing with types YKW and YKWC condulets.

**Condensite**—a booklet issued by the Essex Rubber Company, Trenton, N.J., describing a new substitute for rubber. It is claimed that for insulating work Condensite is far superior to hard rubber and shellac compounds, because of its heat-resisting qualities, high dielectric strength, permanency of finish and sharp molding properties.

**Tubular Steel Tripod**—Several novel features have been introduced into the construction of their folding tubular steel tripod, described in bulletin Y17, of the Herbert Morris Crane & Hoist Company. One feature which will appeal to contractors, structural engineers, stone workers and other users of this kind of lifting gear is the ability to fold up the tripod without removing any bolts or pins. A broad flange is provided on each foot to enable the tripod to carry a load on soft ground, and a square point gives a good grip on harder surfaces. Another new feature is the provision of a pulley at the top of the tripod by which a small rope can be used to haul up the heavy lifting block or to handle very light loads quickly. The one-ton capacity tripod is light enough for one man to carry on his shoulder.

**Cutler-Hammer**—Bulletins Nos. 4500, 4510, 4520 and 4530 describe the new Cutler-Hammer line of automatic machine tool controllers for use with shunt or compound-wound d.c. motors, adapted for constant or adjustable speed work, with or without interpoles. Increased output and lower cost of production is claimed for this automatic control owing to the ability of the operator to start and stop without leaving his normal position; the possibility of the foreman setting the control at the proper speed for a job and leaving the operator free to start and stop, but unable to change speed; and the dynamic brake, by which a tool that would otherwise run several seconds after the power is cut off, is brought to rest practically at once by the motor, which acts as a generator and stops the tool. Bulletin 4510 describes automatic machine tool controllers of the plain starting type; Bulletin No. 4520, those of the speed setting type, and Bulletin No. 4530, those of the speed regulating type. Bulletin No. 6753 describes double-pole diaphragm regulators for d.c. and a.c. motors; Bulletin No. 7131, full magnetic controllers; Bulletin 9125, secondary resistance starting rheostats for polyphase slip ring motors; Bulletin 9130, multiple-switch starters; Bulletin No. 9135 drum type starters; Bulletin No. 9155, drum reverse switches; Bulletin No. 9320, panel type speed regulators; Bulletin No. 9350, drum reversible crane controller; Bulletin No. 9355, hoist controllers; Bulletin No. 9359, rope operated drum reverse switch; Bulletins Nos. 9360 and 9365, speed regulators.



# Current News and Notes

## Brockville, Ont.

Ratepayers of the township of Kitley defeated a by-law to bonus the proposed Gananoque, Arnprior and Ottawa Railway to the amount of \$25,000.

## Charlottetown, P.E.I.

The Patriot has changed over from steam to electric power, and is now operated by two Wagner motors of three and ten h.p. respectively.

## Cornwall, Ont.

A by-law was submitted on October 14th, extending the franchise of the Cornwall Street Railway, Light & Power Company, for twenty years.

## Cow Bay, N.S.

The residents of Cow Bay are discussing the formation of a private exchange to connect with Halifax and Dartmouth.

## Dauphin, Man.

A new 225 kw. vertical type Goldie & McCulloch engine has been installed in the power house here. The old units include 100 kw. and 65 kw. capacity, so that the total power available is approximately 400 kw.

## Dawson, Y.T.

The City Council is planning to establish a municipal electric and telephone plant at an estimated cost of \$165,000.

## Duncan, B.C.

The delivery of machinery for the power house, the contract for which was let to a Glasgow firm, is being delayed on account of European conditions.

## Dundalk, Ont.

The Pine River Light & Power Company have made an offer to this town to supply up to 200 h.p. at \$40 per h.p., the town to pay a certain percentage of the cost of the transmission line.

## Edmonton, Alta.

The Canadian Coal & Coke Company, Limited, have made an offer to the city of Edmonton to supply power at a rate varying from 1.6 cents per kw.h. down to ½ cent, depending on the amount taken. The company ask a contract for twenty-five or thirty years. It is the intention to erect a steam plant at the company's St. Albert colliery.

## Embro, Ont.

The electric sub-station is nearing completion at this point. Power will be supplied from Beachville.

## Fort William, Ont.

Net earnings of the Kaministiquia Power Company for the first ten months of their fiscal year totalled \$229,751, as against \$262,638 for the previous twelve months, so that, at the present rate, the company appears to be maintaining its earning capacity.

## Galt, Ont.

The Dominion Railway Board met in Galt recently to consider the route of the Lake Erie & Northern Railway through this town.

The ornamental standards placed on the steps of High Park some time ago will now be mounted each with a nitrogen-filled tungsten lamp. This was the decision of the Parks Committee at their last public meeting.

## Hamilton, Ont.

Plans are being discussed for the installation of a municipal telephone system. If arrangements can be made with

the Bell Company for long distance service, it is said that the system will be built.

The Brantford and Hamilton Electric Railway Company have applied for an extension to their charter.

## Inwood, Man.

Long distance telephone connection has been established between Inwood, Erinview and Winnipeg.

## London, Ont.

Tenders will be called for two motor-generator sets to be used in connection with the electrification of the London and Port Stanley line.

It is understood that a number of hydro-electric commissions from various points in Ontario will combine in a request to the Provincial Government to inaugurate a municipal telephone system for the province.

## Medicine Hat, Alta.

The Hudson Electric Company have secured contracts from the Maple Leaf Milling Company and the Redcliff Shoe Company for the supply and installation of electrical equipment.

## Montreal, Que.

At the annual meeting of the Sherbrooke Railway and Power Company, held in Montreal, Mr. S. L. Stafford, of Lennoxville, Que., was added to the Board, and retiring directors elected as follows: Messrs. Clarence J. McCuaig, president, Montreal; S. H. Ewing, vice-president, Montreal; Wm. Farwell, Sherbrooke, P.Q.; Frank Thompson, Montreal; D. R. McCuaig, Montreal; W. J. Thorold, London, Eng.; Grant Johnston, Montreal.

The engineering staff of the harbor board of Montreal, Que., is engaged on plans for an electric railway to replace the present steam line which runs along the harbor front. The plan is to elevate the line. Construction work will not be commenced until next season.

Following out the programme of renewing the road-bed of the system, the Montreal Tramways Company are reconstructing further portions of the line. Attention is particularly being given to important intersections, which are being relaid with 132 lb. rails. The new intersections allow for increased car clearance, permitting cars to pass each other in different directions without stopping. The work is being done under the direction of Mr. W. F. Graves, chief engineer.

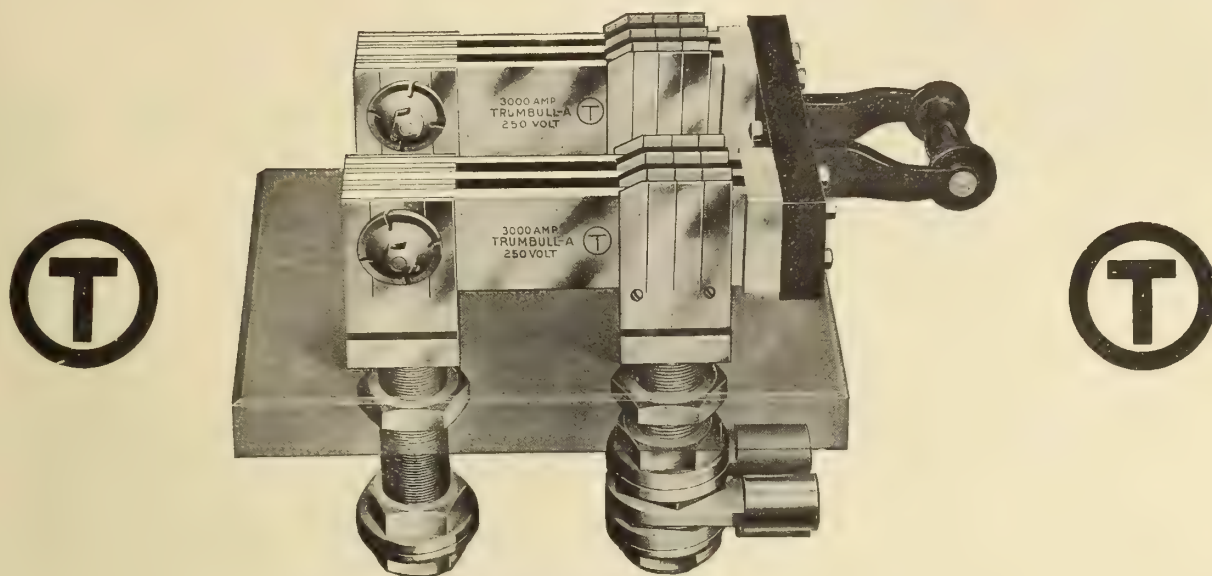
Mr. G. E. Tanguay has been elected president and Mr. C. H. Branchaud vice-president of the Dorchester Electric Company, Quebec.

Messrs. Gray and Smith, Montreal, have obtained a contract for rebuilding the premises of the Bedford Manufacturing Company, P.Q., burned down six months ago and also constructing a dam on the Pike River. The company propose to generate their own power, and will purchase the necessary machinery after the building is constructed next spring. Messrs. Gray and Smith will install the necessary equipment for the electric lighting, including a 7 kw. 125 volt generator, distribution and lighting panels, etc.

Mr. J. J. Creelman, Montreal, having gone to the front, has resigned from the board of the Canadian British Insulated Company, Limited. His partner, Mr. A. Chase Casgrain, K.C., has been elected to fill the vacancy.

Owing to financial reasons, the improved street lighting scheme for St. Catherine Street, Montreal, has been abandoned for this year, but next season it is hoped to install the ornamental standards. Mr. Parent, superintendent of civic





3000 Amp., 250 Volts. Type "A"

# TRUMBULL

"Circle T"

# Knife Switches

**30 to 5000 Amperes**  
(all styles)



Motor Starting Switches showing  
straps on back.

All current carrying parts of Trumbull Type "A" Switches are of pure drawn copper designed to carry easily 100 per cent. overload. The blades have strong reinforcing blocks at the ends, fastened by screws into the fibre cross-bar. The fibre is pre-shrunk by baking for several weeks. The patented handles cannot work loose.

Only the finest workmanship and material are employed in Trumbull manufacture and the most careful attention is given to the minutest details in assembling and adjustment. We carry a stock of our standard material, packed and ready for immediate shipment upon receipt of order.

We manufacture a full line of Knife Switches, Snap Switches, Panel Boards, Cabinets, Switch Boards, Cut-Outs, Rosettes, Receptacles, Service Boxes, Insulating Joints and other Electrical Supplies. If you haven't a catalog, you should have one. Write for it today.

## The Trumbull Electric Mfg. Co.

PLAINVILLE, CONN.

NEW YORK  
114-118 Liberty St.

CHICAGO  
15 S. Desplaines St.

BOSTON  
76-78 Pearl St.

PHILADELPHIA  
138 N. 10th St.

SAN FRANCISCO  
84-88 Second St.



lighting, is also getting out plans for improving the lighting of the public squares—at present poorly lighted. Mr. Parent suggests the removal of the wires and poles on Dominion Square, Phillips Square, Viger Square, and Lafontaine Park, and the installation of local systems of underground conduits. Ornamental light standards are proposed.

The 1914-15 programme of the Canadian Society of Civil Engineers includes the holding of meetings of the Electrical section, on November 19 and March 18. The meetings will be held in the Society's rooms, 176 Mansfield Street, Montreal. Mr. R. M. Wilson is chairman, and Mr. J. C. Smith, vice-chairman, of the section.

#### **Nelson, B.C.**

Mr. W. H. Stevens, superintendent of Dominion Government telephone and telegraph construction in British Columbia, states that work on the Dominion Government telephone line in this district will be commenced almost immediately. A new line will connect Nelson with Trail via Ymir, Salmo, Erie, Sayward and Fruitvale. The poles are being supplied by Mr. J. S. Deschamps, lumber merchant, Nelson, to the number of 1,900.

#### **Niagara Falls, Ont.**

The proceeds of the local electric railway system for one day, October 3rd, were donated to the Canadian Patriotic Fund, the fares being collected by the women of the town.

The local hydro-electric commission recently visited Hamilton to inspect the new lighting system there. It is probable a similar system will be installed in Niagara Falls.

#### **Orillia, Ont.**

During dredging operations on the Trent Valley Canal in the Ragged Rapids district, the water in the river will be lowered, by arrangement, so that the full power of the Orillia plant will not be available. The requirements of this town will be supplied from the Big Chute plant and the dredging contractors agree to pay the extra expense incurred.

#### **Ottawa, Ont.**

The first sod of the Ottawa and St. Lawrence Electric Railway was turned at Russell recently. The first division of the road is to be 119 miles in length and run from Ottawa to Morrisburg and on to Beaudette with a branch line from Metcalfe to Russell.

#### **Owen Sound, Ont.**

There seems to be a possibility that work will be commenced in the near future on the dry-dock to be built at this point. The operation of this plant will require some 700 h.p., which will be available from Eugenia Falls.

#### **Peterborough, Ont.**

The Peterborough Radial Railway Company are constructing a spur to connect with the C. P. R.

#### **Port Arthur, Ont.**

The Port Arthur Hydro-Electric Commission recommend that a by-law be submitted to the electors in January, authorizing the expenditure of \$44,600 for a new sub-station at the pump house.

#### **Runnymede, Ont.**

The Ratepayers Association of this district are agitating for the operation of Sunday cars on the Toronto Suburban Railway Company's lines.

#### **Regina, Sask.**

The operation returns of the Regina Municipal Railway System for the week ending September 19th were as follows: Revenue, \$3,052.80; passengers carried, 72,222. The corresponding figures for the week ending September 26th were \$3,151.15 and 75,011.

#### **Sault Ste. Marie, Ont.**

On October 1st the Tagona Water & Light Company's

property was taken over by the municipality and the plant will in future be operated as a municipal enterprise. The company has been operating on a twenty-year franchise, which expired on the above-mentioned date.

#### **Stettler, Alta.**

A by-law authorizing the expenditure of \$5,000 on electrical equipment was carried.

#### **St. John, N.B.**

The St. John Street Railway Company have started work on the extension of their line along Marsh Road.

#### **St. Thomas, Ont.**

The monthly record of the city's municipal street railway income shows increases over the corresponding figures of a year ago.

#### **Toronto, Ont.**

Mayor Hocken is authority for the statement that negotiations regarding the purchase of the Toronto Street Railway System are postponed for the present at least.

The Hydro-Electric Power Commission have recommended Mr. J. Shields as head of the Electrical Inspection Department of the city of Toronto.

The Ontario Railway and Municipal Board has ordered that the Toronto Railway Company shall complete the line on Teraulay Street between Agnes and College by the first of November.

The City Council has authorized the further issue of bonds by the local Hydro-Electric Commission to the extent of \$1,000,000. The Commission asked to be allowed to raise \$2,000,000. The greater part of the \$1,000,000 has already been expended in necessary extensions.

The Board of Control are considering the extension of the Bloor Street car line in West Toronto. The work will probably be carried on by day labor.

An application of the Toronto Railway Company to the Ontario Railway and Municipal Board for permission to lay a siding along the west side of Church Street, close to the company's offices, for the purpose of collecting the fare boxes from the passing cars, has been refused.

Arrangements have been made between the city and the Toronto Railway Company for the reconstruction of the track allowance on College Street between Spadina and Lansdowne Avenues, and work between Spadina and Bathurst will be completed this year.

Municipalities north of this city will vote on October 19, on expenditures for hydro-radials as follows:—Markham, \$48,762; Newmarket, \$266,986; Pickering, \$578,115; Williamsburg, \$2,750; Twp. of Scarboro, \$565,714; Twp. of Markham, \$803,939.

#### **Vancouver, B.C.**

An order has been received by the Canada Wire & Cable Company (agents, Macdonald Marpole Company, Vancouver) from the West Kootenay Power Company, for 18½ miles of bare hard drawn copper wire.

The Electrical Repair Company maintain a twenty-four hour service. This is a development in the electrical contracting field that has met with considerable favor with the public, and is proving generally profitable to the contractors themselves.

The effect of the present trade depression in Vancouver is shown by the fact that some 6,000,000 less fares have been collected during 1913 than over a similar period a year ago. This is partly accounted for, however, by an increase in the fare.

#### **Winnipeg, Man.**

The Canadian Westinghouse Company have been awarded a contract by the Board of Control for six oil circuit breakers electrically operated. These are to be installed at the municipal generating plant at Point du Bois.



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Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

The proprietors of Letters Patent No. 144377 relating to "Method of and Apparatus for Manufacturing Sinking Weights for Fishing Tackle," desire to dispose of the Patent or to grant License to interested parties at reasonable terms with a view to the adequate working of the Patent in Canada.

Inquiries to be addressed to the actual proprietors, Jon Poulssons Fiskredskapsfabrik, Delsbo, Sweden.

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## Lighting Schedule for November, 1914

Courtesy of the National Carbon Company, Cleveland

Date.	Light.	Date.	Extinguish.	No. of Hours
Nov. 1	3 40	Nov. 1	5 40	2 00
2	No Light	2	No Light	
3	No Light	3	No Light	
4	No Light	4	No Light	
5	5 20	5	7 40	2 20
6	5 20	6	8 30	3 10
7	5 20	7	9 30	4 10
8	5 20	8	10 30	5 10
9	5 20	9	11 40	6 20
10	5 20	11	0 50	7 30
11	5 10	12	2 00	8 50
12	5 10	13	3 10	10 00
13	5 10	14	4 20	11 10
14	5 10	15	5 40	12 30
15	5 10	16	6 00	12 50
16	5 10	17	6 00	12 50
17	5 10	18	6 10	13 00
18	5 10	19	6 10	13 00
19	5 10	20	6 10	13 00
20	5 00	21	6 10	13 10
21	5 00	22	6 10	13 10
22	5 00	23	6 10	13 10
23	5 00	24	6 10	13 10
24	10 40	25	6 10	7 30
25	11 40	26	6 10	6 30
27	0 40	27	6 20	5 40
28	1 40	28	6 20	4 40
29	2 40	29	6 20	3 40
30	3 40	30	6 20	2 40

Total Hours.....221.10

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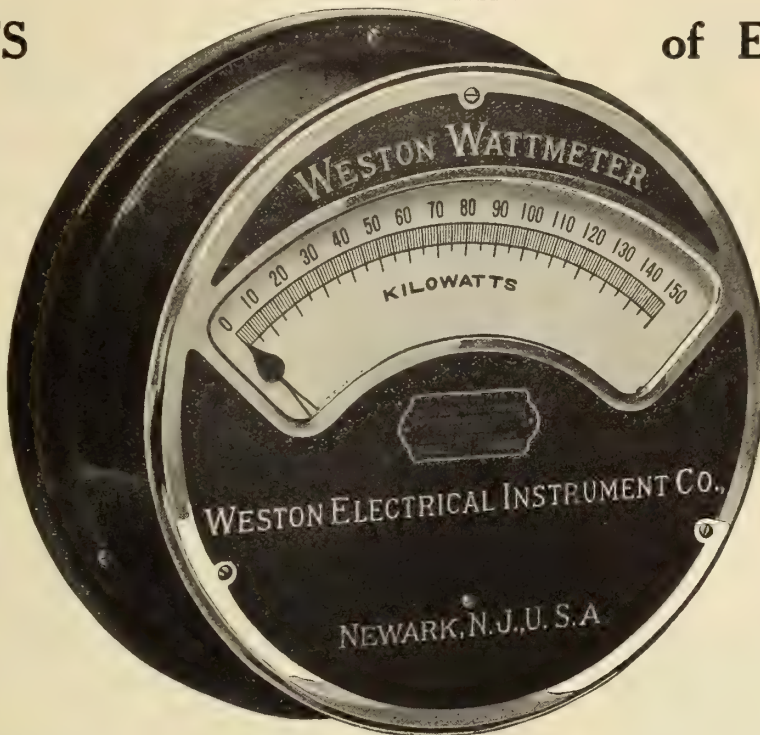
3. The indications are equally accurate on direct-current circuits or on alternating current circuits of any frequency, power-factor or wave form within commercial limits. Therefore, these watt-meters can be calibrated with direct-current and used on alternating-current circuits without change of calibration.

4. The scale is flat and is therefore easily read.

5. The pointer is entirely free from vibration produced by mechanical resonance.

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8. They are far more reliable and durable than any commercial wattmeter heretofore built.

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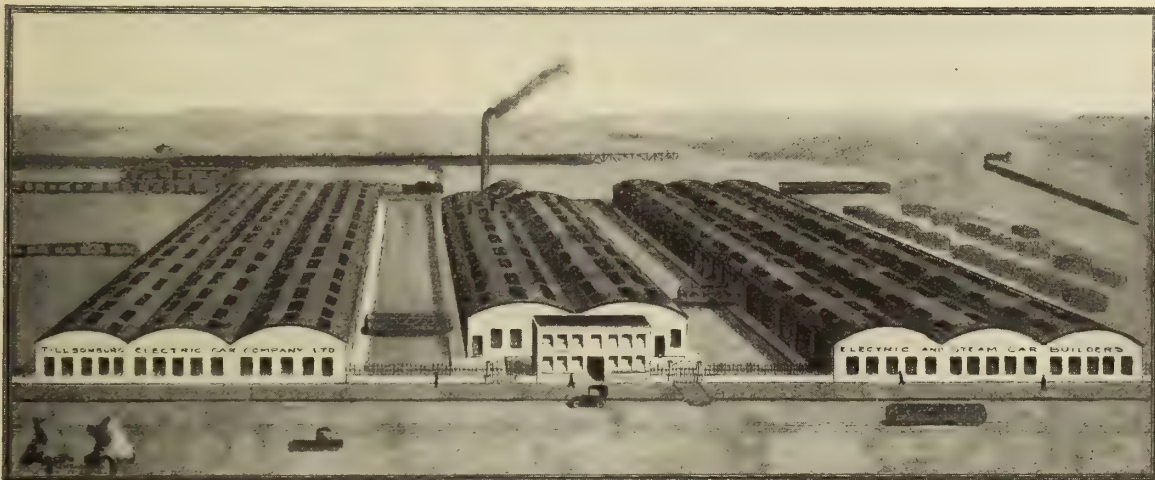
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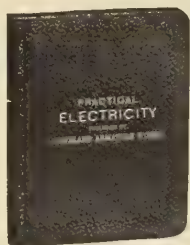
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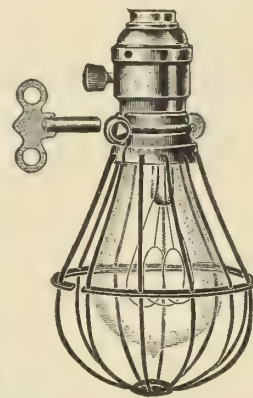
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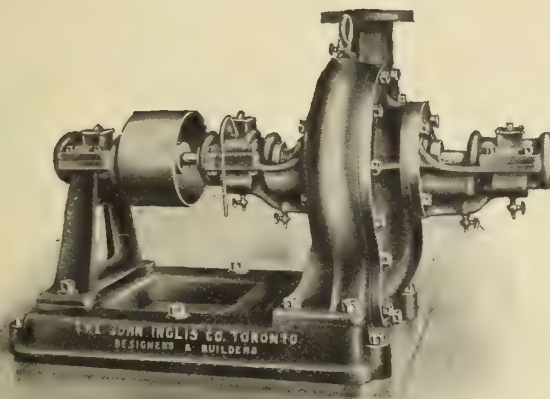


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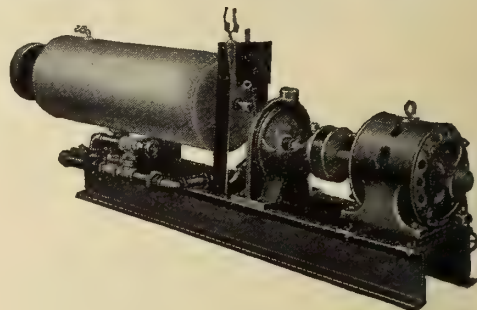
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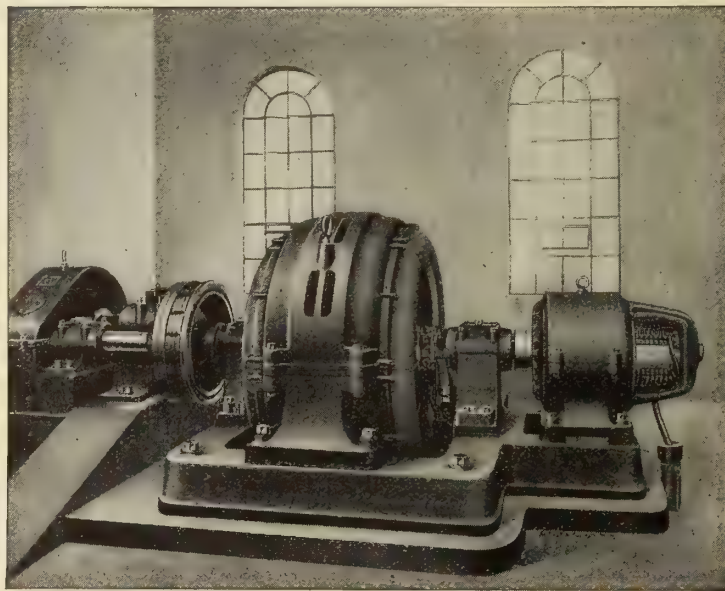
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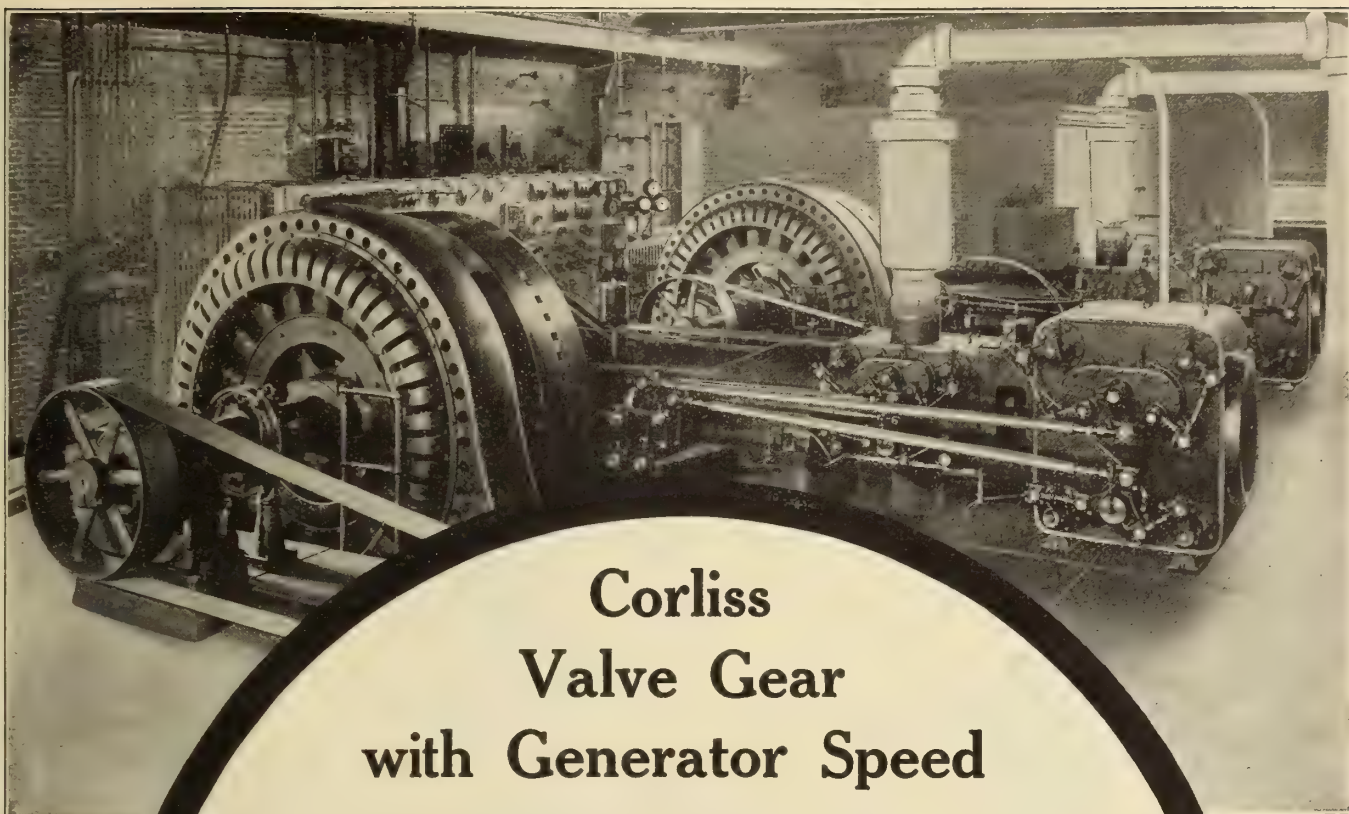


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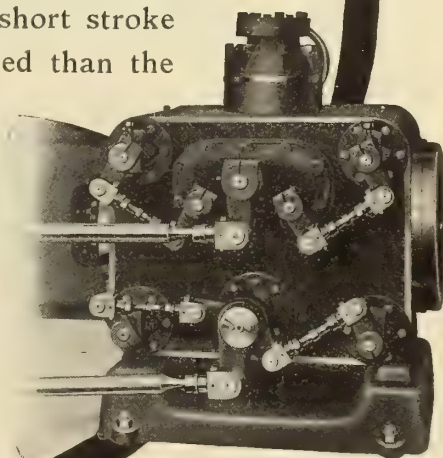
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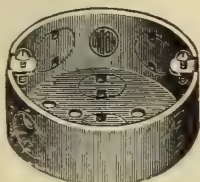
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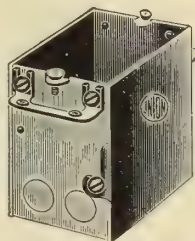


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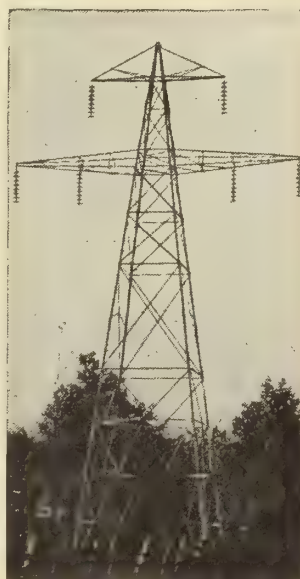
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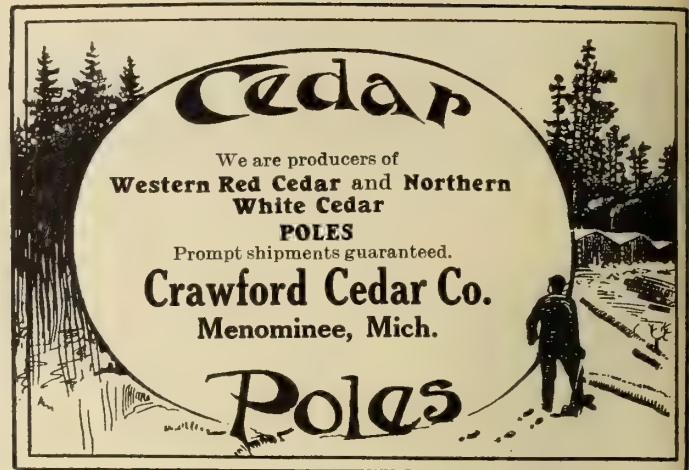
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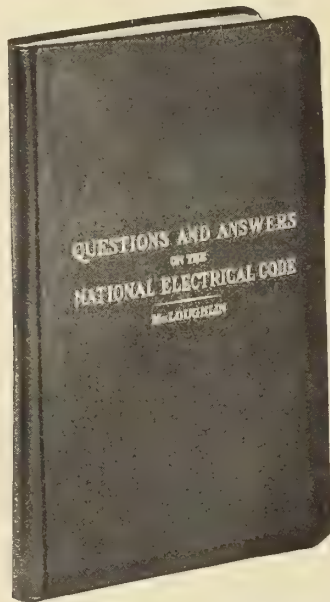


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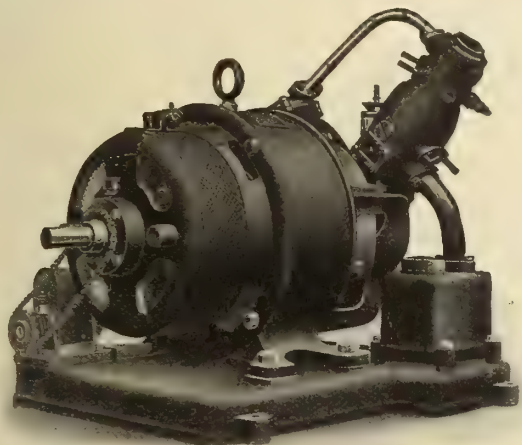
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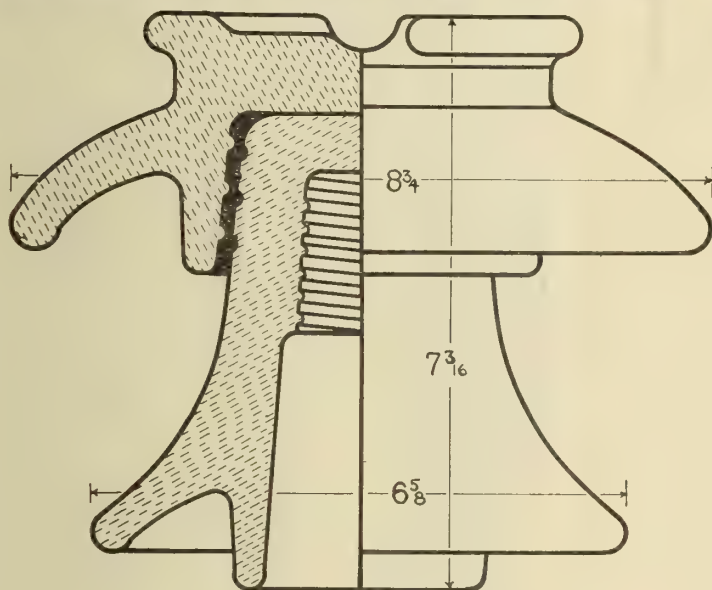
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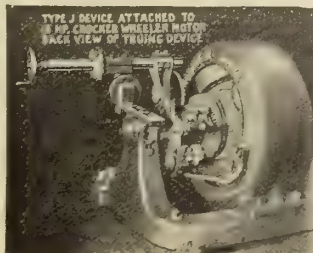
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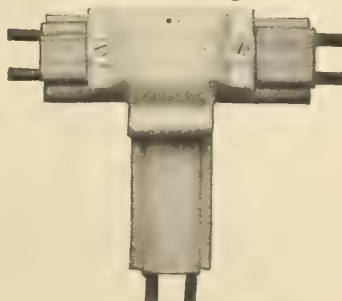
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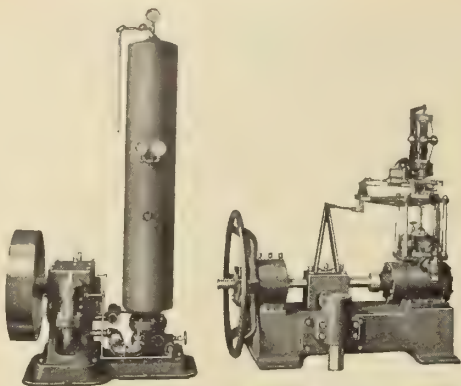
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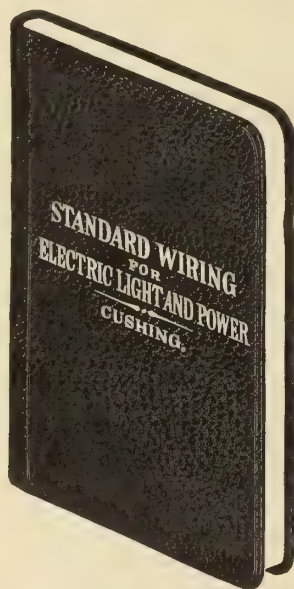
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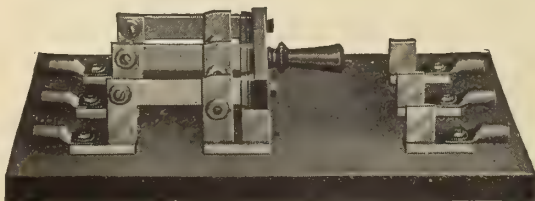
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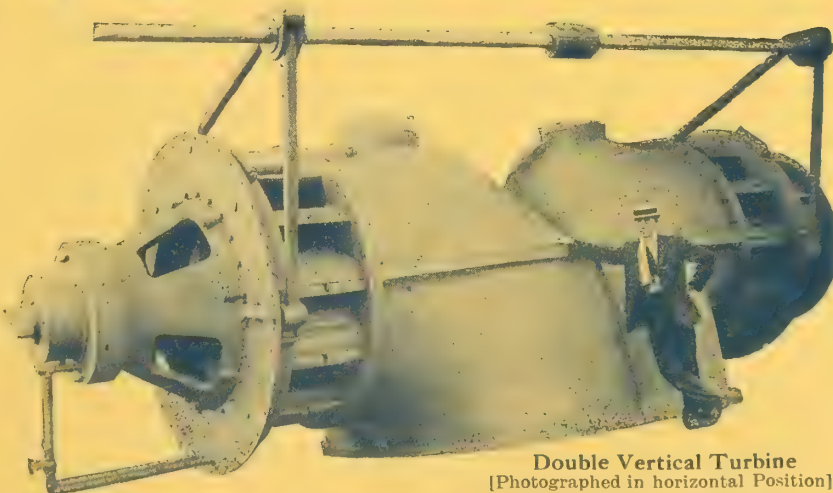


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In the double boxes a steel partition prevents access from the

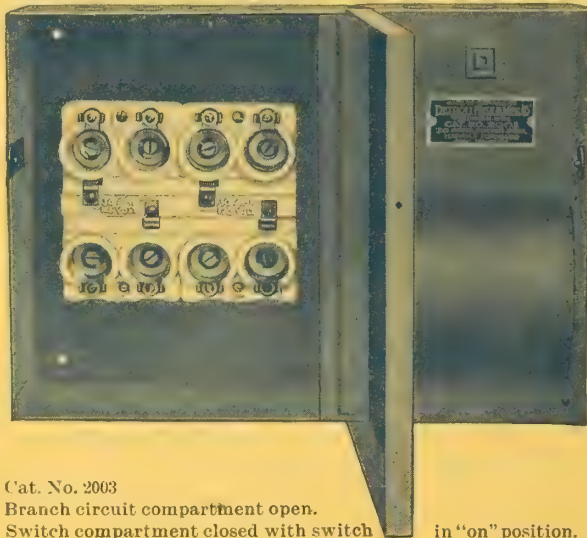


Cat. No. 5211-E  
Cover closed and locked.  
Switch in "locked off"  
position.

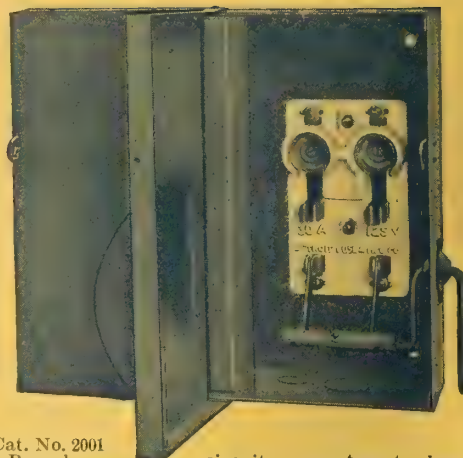


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"Square D" Enclosed Entrance Switches and Distributing Cabinets meet the latest requirements of the Hydro-Electric Power Commission of Ontario.



Cat. No. 2001  
Branch circuit compartment open.  
Switch compartment closed with switch in "on" position.



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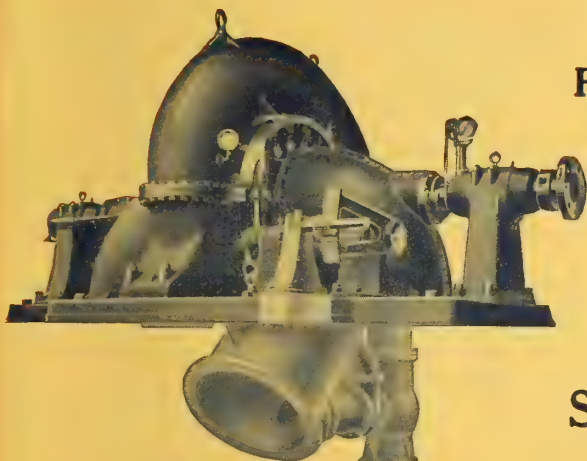
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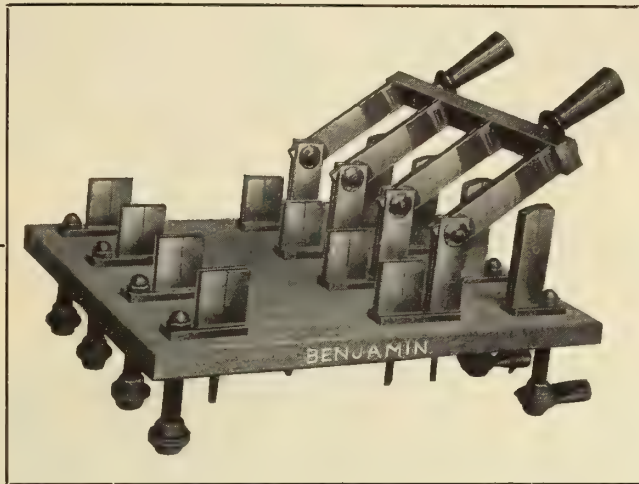
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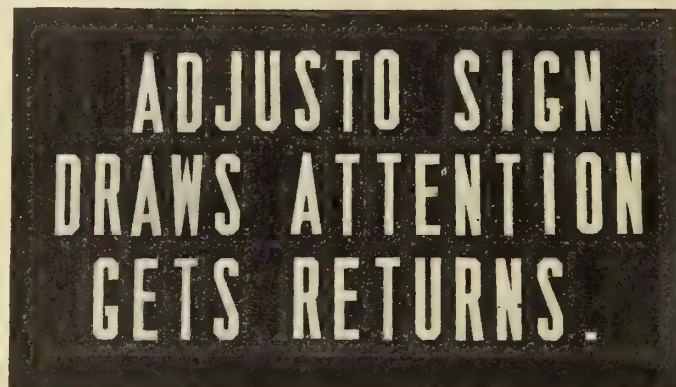
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Type CLOC—For use with Centre Ceiling Fittings.



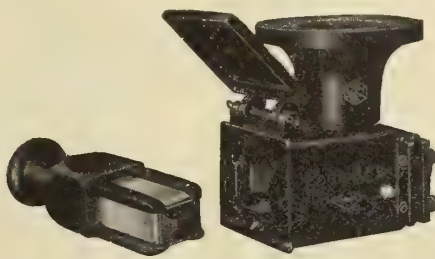
Type JRR—For use back of Mouldings with rectangular Base Fittings.



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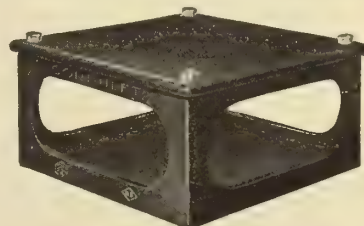
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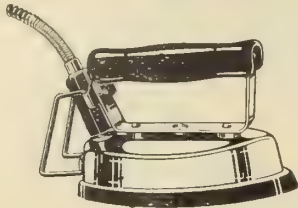
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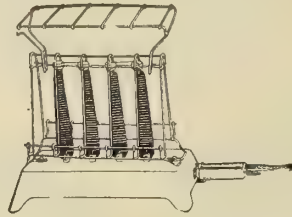
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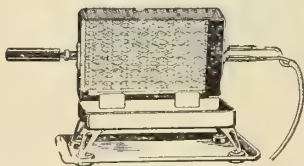
Coffee Pot



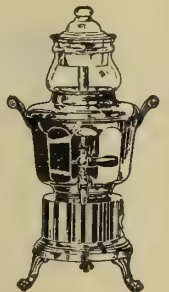
Chafing Dish



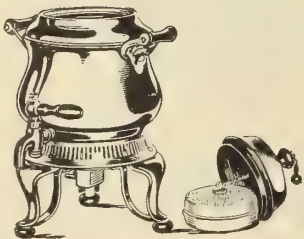
Heating Pad



Radiant Grill



Coffee Urn



Tea Samovar



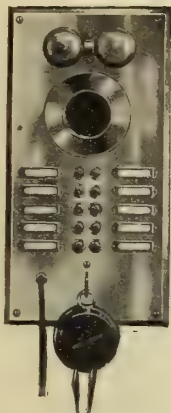
Milk Warmer



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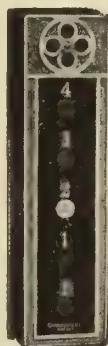
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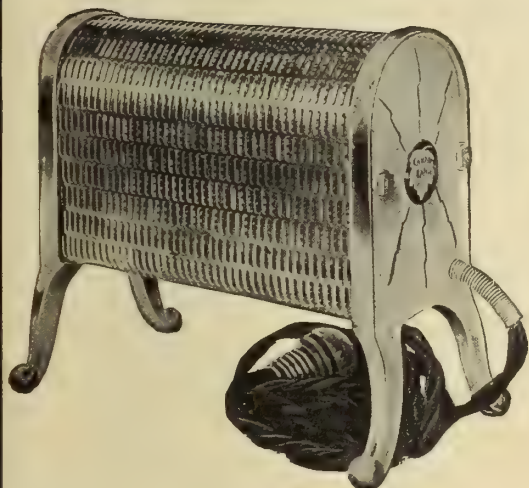
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A neat, compact, portable Air Warmer, specially designed for Fall and Spring months, as an efficient heater for ordinary sized rooms and as an auxiliary for isolated rooms during severe winter weather. Retail at \$6 00—A sure sales puller.



Trade Mark

### A Pair of "Canadian Beauties"

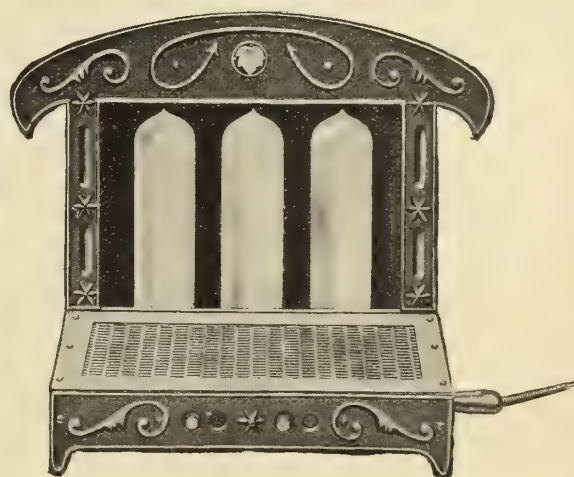
#### Power Companies

Increase your load and sales by ordering a stock of these for the Xmas trade.

Electricians and Contractors increase your sales likewise by stocking and demonstrating these goods.

Support Canadian workmen by selling only—

"MADE IN CANADA GOODS."



### Portable Type Luminous Radiator and Foot Warmer Combined

The "Canadian Beauty" above illustrated is a distinct advantage over other makes inasmuch as there is a foot-warmer attached, heated by a separate unit which adds to the utility of the Radiator. Retail price, including 10 feet of cord and lamps, only \$18.00. Lamps and Footwarmer are operated by separate switches. A demonstration of this Radiator to a prospective buyer gets him every time.

*Manufactured and Sold Exclusively by*

**Renfrew Electric Mfg. Company, Limited**  
RENFREW, ONTARIO, CANADA



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**The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers**





Provincial Law Courts, Winnipeg. A "GALVADUCT" Building.

# GALVADUCT

## "LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us

## "GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify "Galvaduct" or "Loricated" Conduits

**Conduits Company Limited.**  
Toronto - Montreal

# LORICATED



# **We Are Ready For Your Orders**

There are ready for delivery in warehouses in Montreal, Toronto, Winnipeg and Vancouver, large stocks of the well known

## **LACO TUNGSTEN LAMPS**

including all sizes of NITRO, PROJECTOR and other types of lamps we regularly list. We are also adding to our stocks every week.

IN THESE TIMES when economy must be exercised LACO lamps should be handled, as they will give your customers longer life, brighter light, at less cost than any lamp on the market today.

### **Canadian Laco-Philips Co., Ltd.**

**Montreal  
Winnipeg**

**Toronto  
Vancouver**



# The Autosign

*An Interchangeable Electric Sign*

**Made-In-Canada**



This is a Canadian designed and made sign that is capable of being completely changed in a few minutes to advertise the goods of practically every retail store.

The Autosign possesses a simple distinctive beauty obtained by the contrast of an exquisite white glass plate mounted in a polished ebony frame. The white plate contains grooves into which are fitted pure rubber letters over which is drawn a plain glass cover.

With each outfit is furnished one hundred pure rubber unbreakable letters and figures, tungsten lamp, flasher, eight feet of cord and attachment plug.

This is the only high class electric interchangeable sign of its kind that is "Made-in-Canada". It is ahead of any of its competitors and lower in price.

**Made in any size.**

## **"A Live Line" For a Smart Dealer**

This is a good selling line and to a "Live Wire" dealer who is prepared to push the Autosign we have a mighty good proposition.

**Write us for your territory—today.**

**SOLE DISTRIBUTORS FOR CANADA**

# Roper, Clarke & Co., Limited

Suite 422 Coristine Building, MONTREAL

*Engineers, Importers and Manufacturers Agents*



# *made in* **Canada**

## —as a Canadian Manufacturer

The Northern Electric Company predominates in the making of Wires and Cables, and Telephone and Fire Alarm Equipment of all kinds. Its plant and personnel are truly typical of the high standards which support the "Made-in-Canada" platform.

Canadians know this company as "THE MAKERS OF THE NATION'S TELEPHONES." All the big private and Government-owned operating telephone companies use our Telephone Equipment; most use it exclusively. The Big railroads—the C. P. R., G. T. R., I. C. R., G. T. P., and T. & N. O. use N. E. Telephones for train despatching. The Government uses it extensively for military and forestry work.

Every kind of wire and cable for electric transmission is made from magnet wire, finer than a strand of hair, to high-tension, lead-covered cables for power and telephone work three inches in diameter.

The enormous increase in this branch of the company's business has necessitated the erection of a new plant at Montreal, which will be the largest single plant in America for the exclusive manufacture of wires and cables.

That we turn out the most reliable fire alarm equipment is best evidenced by the fact that Northern Electric-Gamewell apparatus is specified and used by cities, towns, and villages in the Dominion that are equipped with fire or police alarm apparatus. This in spite of active foreign competition. With the record of its unparalleled performance under all conditions of weather, you are more than justified in giving Northern Electric-Gamewell equipment your unqualified support.

In the design and manufacture of power switchboards it is our aim to cater to each customer's individual requirements. Each switchboard embodies the most careful and exacting workmanship along lines laid down by engineers well versed in the correct principles of switchboard design.

The rapid growth of this department since we commenced manufacturing for other than our own equipment, is conclusive evidence that eventually our switchboards will be universally specified.

# **Northern Electric** **Company • Limited**



# made in Canada

—as a Canadian Distributor

Entirely apart from its enormous manufacturing facilities, the Northern Electric Company is the largest jobber of electrical supplies in Canada.

**NORTHERN LIGHT Mazda Lamps** give three times the amount of light as compared with carbon lamps at no increase in the light bill. They are carried in all standard shapes and sizes from 1 c.p. to 2,000 c.p. These lamps come neatly packed in attractive and distinctive carton boxes. Northern Light Mazda Lamps give the greatest satisfaction in use.

We are also selling agents for Canadian-made Duncan Sockets, Switches, etc., Benjamin Lighting Specialties, Chadwick Lighting Fixtures; Arc Lamps; Holophane Reflectors; Jefferson Glass Shades and Franklin Portables.

**"NORTHERN SIX"** batteries, either regular or ignitor, are of characteristic Northern Electric quality. Large stocks are carried at each house so you may always be assured of fresh batteries and prompt shipments.

We are also selling agents for Canadian-made Crouse-Hinds Condulets, Conduits Company Iron Conduit, Acme Steel Brackets; Glass Insulators; Pole Line Hardware and Street Railway Overhead Material.

We are the largest distributors of tape in Canada. **"Nor-el-co"** friction tape and **"Victor"** splicing compound are the two best sellers on the market. The former is a closely woven tape, having exceptional sticking qualities, while the latter is a low-priced rubber splice, suited to all ordinary electrical work. Four other grades make up the most complete line of tapes and splicing compounds.

We are also selling agents for Canadian-made Westinghouse Watthour Meters; Sterling Rubber Gloves; Eveready Flashlights; Hughes Electric Ranges; Cross-arms in fir or pine.

The Northern Electric Low Voltage Lighting Outfit is the most efficient equipment on the market to-day for the lighting of farm dwellings and private estates, fish and game clubs or other places situated where there are no public lighting facilities.

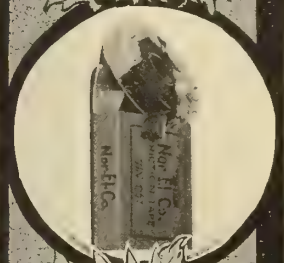
We are exclusive selling agents for many of the best known electrical manufacturing concerns on this continent.

Our customers benefit from the excellent geographical location of each branch house at which large stocks are always maintained for immediate shipment.

**Northern Electric Company**

LIMITED

Montreal Winnipeg Edmonton Halifax Regina Vancouver Toronto Calgary Victoria



# Northern Electric Company Limited



# "Buy Early"

**T**HE very nature of electrical heating devices makes them the most appropriate gifts at Christmas time.

In this respect electrical dealers have a marked advantage over other retailers in being able to offer gift suggestions of exceptional usefulness and practical value.

We have the most complete line of highest quality heating devices ready for the Christmas trade. These consist of Irons, Toasters, Coffee Percolators, Warming Pads, Tea Samovars, Curling Iron Heaters, and many others.

Other electrical commodities suitable for Christmas gifts are Christmas Tree Outfits, Hair Dryers, Vibrators, Washing Machines and electrical toys.

All these devices are guaranteed by a guarantee that means something.

Some very attractive window displays have been made up specially for the Xmas season; they are simple yet have strong selling attention value. You can get copies of these by writing our nearest house—they are furnished gratis.



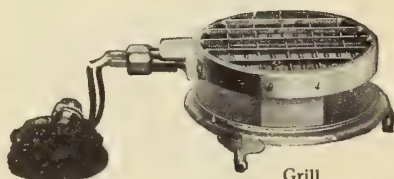
Electric Iron



Toaster



Coffee Percolator



Grill



Curling Iron Heater



Chafing Dish

## Northern Electric Company

LIMITED

MONTREAL  
HALIFAX  
TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA





When you buy lamps watch out for the "just as good" kind. The chances are they're no good. If you value your reputation you will stock up on genuine Canadian made

## *Northern Light* Mazda Lamps

These lamps are made in Canada by Canadians and for Canadians. The range of shapes and sizes is complete from 1 c. p. to 2000 c. p. They all come neatly packed in cartons, the smaller sizes five to a carton.

These cartons stack up well on shelves, make stunning window displays and are most convenient for storage purposes.

It's easy to sell **Northern Lights** by the box instead of one at a time—and every time you sell a customer five lamps instead of one, you make a convert to the "buying lamps by the box" idea.

**Put in a stock of NORTHERN LIGHTS  
now—then watch your cash register results.**

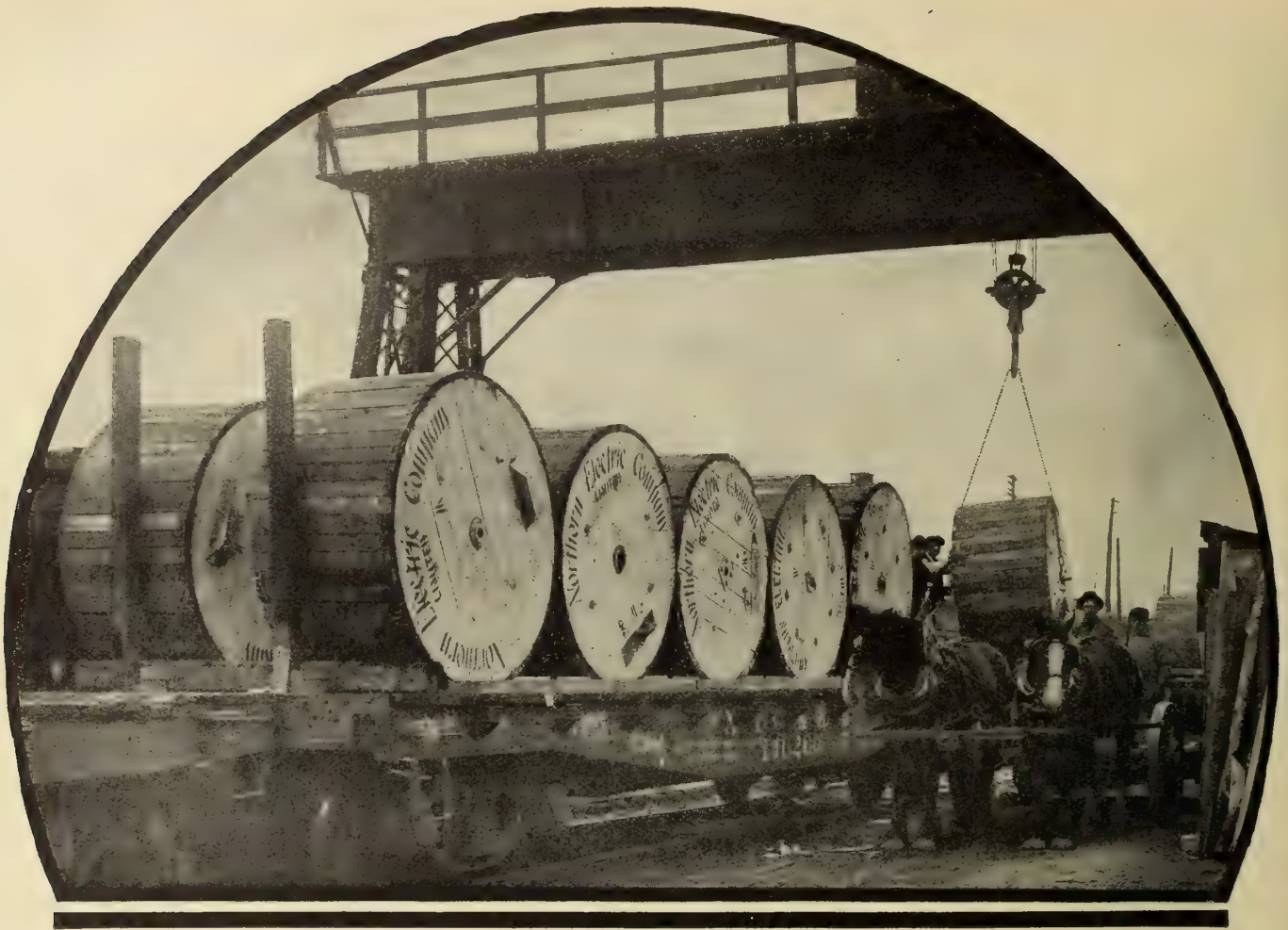
# *Northern Electric Company* LIMITED

MONTREAL  
HALIFAX  
TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA





Just a Part of One Order for  
*Northern Electric*

High-Tension, Lead-Covered, Paper-Insulated  
**POWER CABLES**

**I**T took 17 freight cars like the one illustrated to ship this complete order to the Cedar Rapids Manufacturing and Power Company's new generating station at Cedar Rapids, Que.

**Q** It pays to place your orders with a Company that gives quality based on knowledge gained through long manufacturing experience.

**Q** It pays to deal with a Company that has the greatest facilities for the prompt handling of orders for every kind of wire and cable used in the electrical industry.

**Q** It pays to place your orders with the Company that has the confidence of the Central Station men as well as the most prominent members of the engineering profession.

*Northern Electric Company*  
 LIMITED

MONTREAL

CALGARY

HALIFAX

EDMONTON

TORONTO

VANCOUVER

WINNIPEG

VICTORIA

REGINA



# See Things In a Better Light—and Buy

OUR UNBREAKABLE

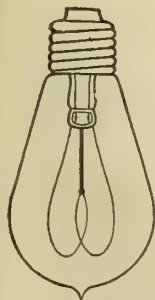
## TUNGSTEN and CARBON LAMPS

Every lamp sold under a positive guarantee of satisfaction—both to you and to your customers.

These lamps are made by the best lamp manufacturers in the world, and consume much less current than inferior brands.

GET OUR SPECIAL WAR DISCOUNTS

**Volt Electric Company, Limited,** 37-41 Britain Street  
Toronto, Ont.



## “The Recognized Authority on Wiring and Construction”

—The Electrical Journals of the United States, Canada and England

Over 297,000 Sold

By H. C. Cushing Jr.

*Fellow American Institute of Electrical Engineers; formerly  
Electrical Inspector for Boston Board of Fire Underwriters  
and Underwriters' Tariff Association of New York.*

20th Year

20th Edition



## 1914 Standard Wiring

is the only book on Electric Light and Power Wiring and Construction endorsed and recommended by every Board of Fire Underwriters in the United States and Canada, because it is the only one kept strictly up-to-date and revised every year in accordance with every rule and requirement of the

### National Electrical Code

which it contains, explained and illustrated. The 1914 Edition has been completely revised from the first to the last page, and contains new illustrations, tables and diagrams in accordance with the latest and best practice.

“It settles disputes and, if referred to before wiring, prevents disputes.”

Sent to any address,  
postpaid, on receipt of

**\$1.00**

Leather Cover  
Pocket Size

Electrical News,

347 Adelaide Street West,

Toronto, Canada

“The Best Book on Wiring Ever Produced”—E. T. BIRDSALL, M.E., A.I.E.E.



## KNIFE SWITCHES

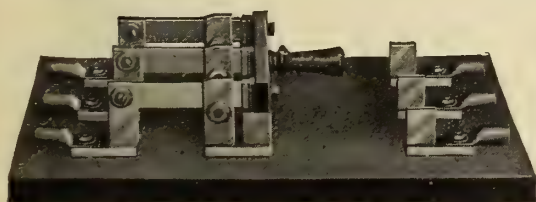
30 to 5000 AMPERE



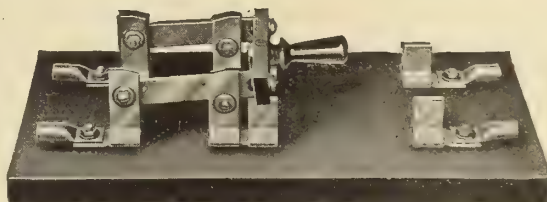
Front Connected  
Back Connected

Motor  
Starting  
Switches

Write for  
catalog No. 21



Type “A” See catalog, pages 6 to 11.



Type “F” See catalog, pages 16 to 21

FRANK ADAM ELECTRIC COMPANY

ST. LOUIS, Missouri, U. S. A.



***"Do it Electrically"***

# **ELECTRIC SIGNS**

OF EVERY TYPE AND DESIGN



By

***The Macey***  
**SIGN CO.**

LIMITED

257 King Street West,

**TORONTO**

Lighting Companies write us about our  
**ELECTRIC SIGN CAMPAIGN**

# **Electrical Decorations For Rent**

**WE** make a specialty of High-Class Decorations for Street Fairs, Carnivals, Celebrations, Centennials, Old Home Weeks, Street Conventions, Conclaves, Parks, Buildings, Auto Shows, Balls, Fairs, Dances, Banquets, Industrial Expositions, Food Shows, Christmas and New Years, etc.

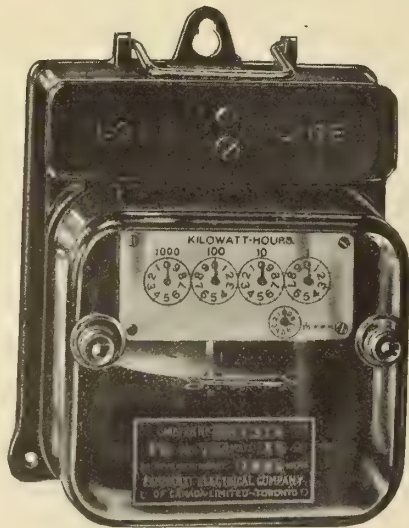
Our decorations are elaborate, appropriate and refined. We carry a complete line of Electrical Set Pieces, Signs, Streamers of Lights and Bunting for all Lodges, Orders and all occasions. Get our prices and designs.

Contractors and Dealers are requested to get in touch with us.

## **Electrical Decorative and Equipment Company**

70 Lombard Street, Toronto, Ont.

Long distance phone Main 3634



# **Ferranti Meters**

are built up in

## **TORONTO**

Large stocks carried  
of all types and sizes

**Write for our most recent  
bulletins and prices.**

## **FERRANTI ELECTRICAL COMPANY OF CANADA LIMITED**

90 Sherbourne St.

**TORONTO**

704 Unity Bldg.

**MONTREAL**

Farmer's Advocate Bldg.

**WINNIPEG**

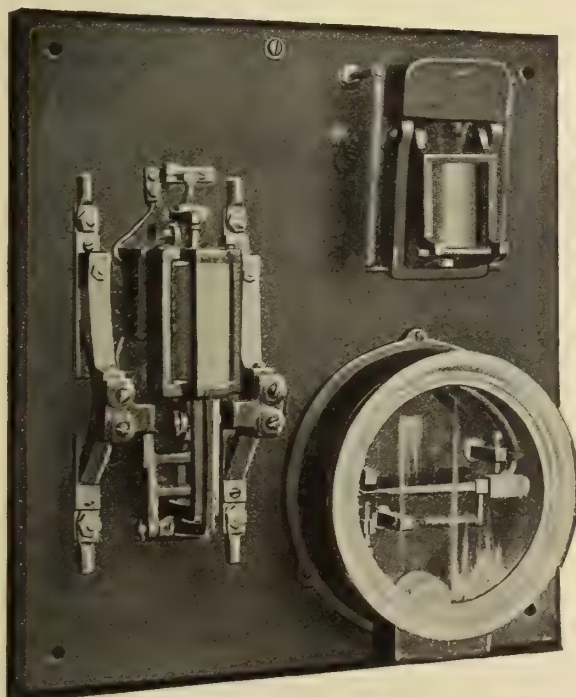


# **G. M. Gest**

## **Conduit Engineer & Contractor**

*Head Office  
503 Power Building, Montreal, Can.*

## **SUNDH PRESSURE REGULATORS**



**For use in starting A. C. and small D. C. Motors.**

Specially designed for installations where they can be thrown across the line without the use of starting resistance. Compact and reliable and will not get out of order.

When the amperes taken by motor exceed the 10 amp. capacity of the magnet switch, a switch of large capacity is added, the magnet switch acting as a relay.

We manufacture a complete line of controlling devices, such as Motor Starters, Pressure Regulators, Tank and Sump Switches, Panels, etc.

**Send for Catalogue.**

**Sundh Electric Company**

- -

**New York, U.S.A.**





# EUREKA

## Reduced To \$39.50

The same efficient Eureka Vacuum Cleaner is now being sold for \$5.50 less than in the past.

East of Winnipeg the retail price is \$39.50

Winnipeg and the West, price is \$44.50

Complete set of attachments \$10.00

This reduction is the result of the big increase in sales of the Eureka.

Write us for dealers' proposition.

## Onward Mfg. Co.

Berlin, Ont.



# You Want The Best

## Specify

# "Moloney"

## satisfaction

# Transformers

QUICK SHIPMENTS OUR SPECIALTY

MADE IN CANADA

## Moloney Electric Company of Canada, Limited

WINDSOR, ONTARIO

General Sales Office—Traders Bank Building, TORONTO

Branch Offices

MONTREAL

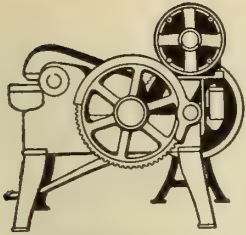
WINNIPEG

CALGARY

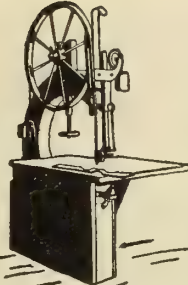
VANCOUVER



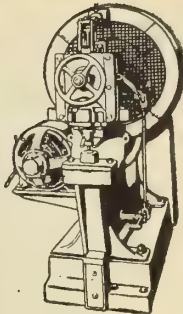
# CUTLER-HAMMER



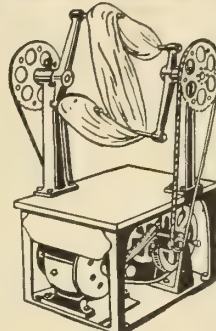
Alligator Shears



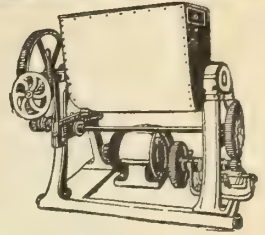
Band Saw



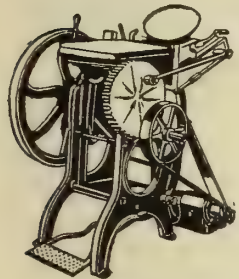
Punch Press



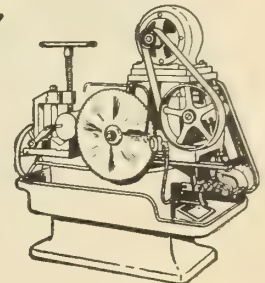
Candy Puller



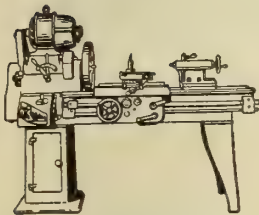
Dough Mixer



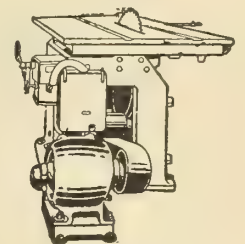
Platen Press



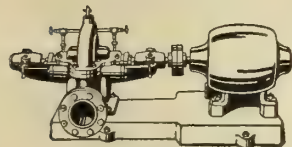
Metal Saw



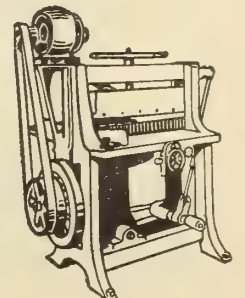
Lathe



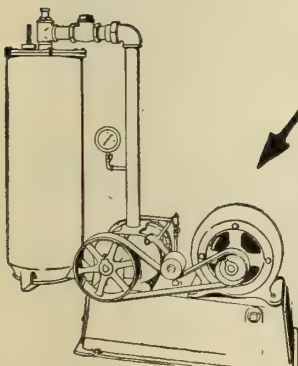
Wood Saw



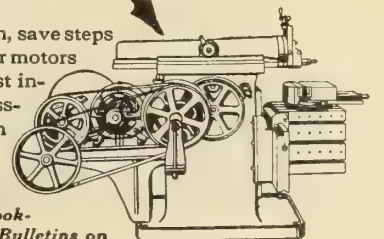
Pump



Paper Cutter



Vacuum Cleaner



Shaper

## PUSH THE BUTTON

and start any of your machines

Save current—give the operator easy means of starting and stopping and he will shut down his machine when not in actual use. Cutler-Hammer automatic starters have important advantages over hand starters in many cases.



Eliminate lost motion, save steps and time, protect your motors and machines against inexperience or carelessness. Just push the button.

Ask for automatic starter booklet containing Bulletins on this subject.

**THE CUTLER-HAMMER MFG. CO.**

**MILWAUKEE**

NEW YORK: 50 Church Street

CHICAGO: Peoples Gas Bldg.

PITTSBURG: Farmers' Bank Bldg.

BOSTON: Columbian Life Bldg.

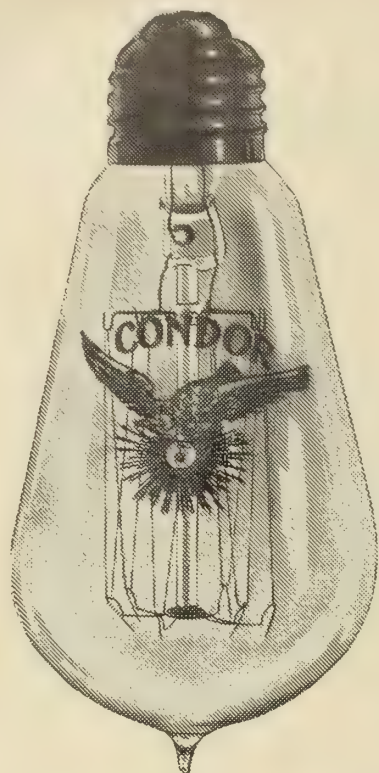
PHILADELPHIA: 1201 Chestnut Street

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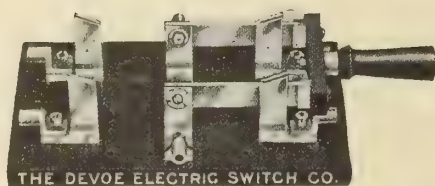
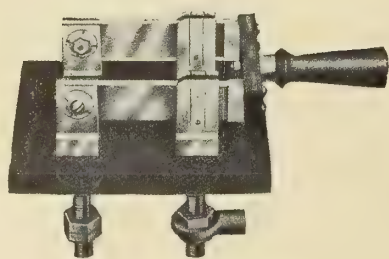
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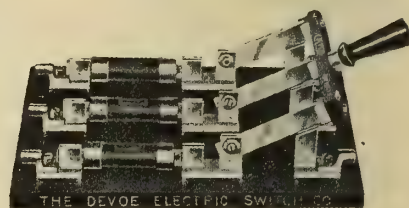
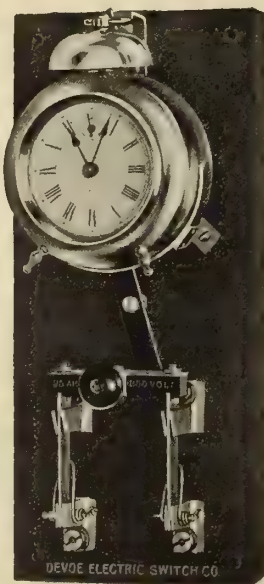
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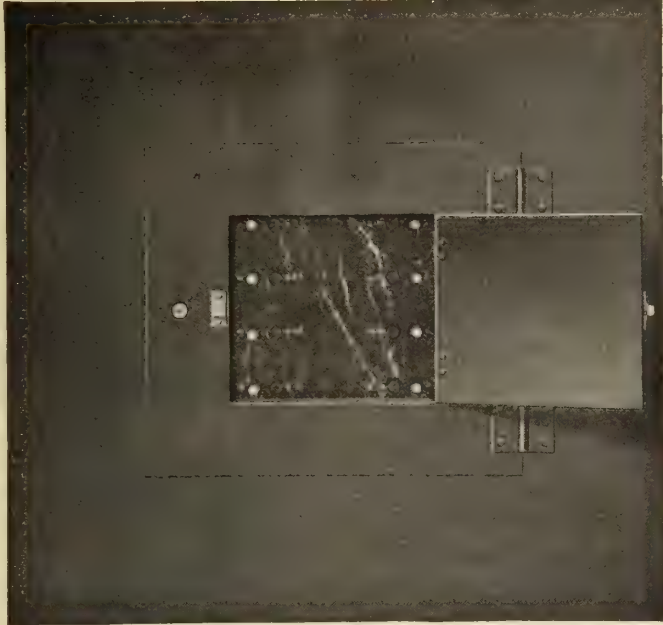
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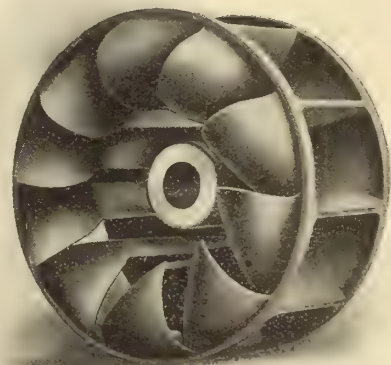
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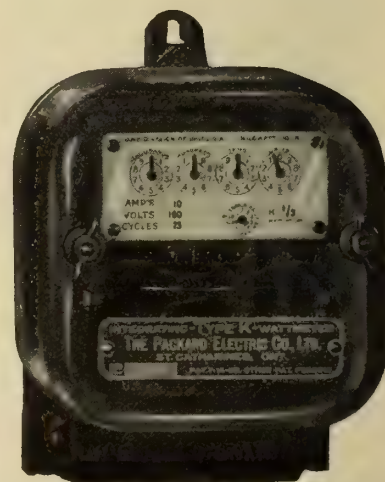
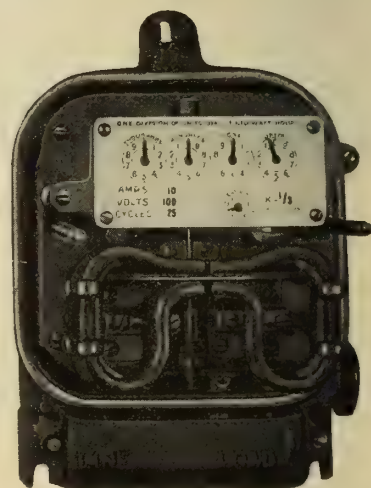
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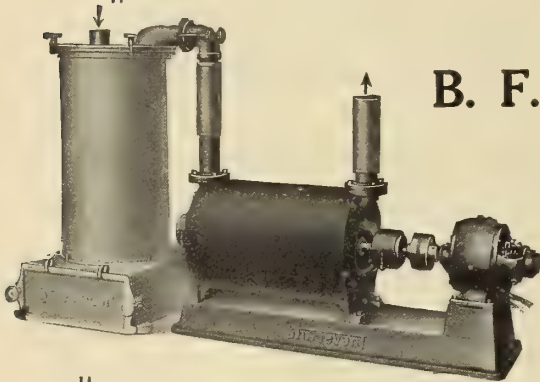
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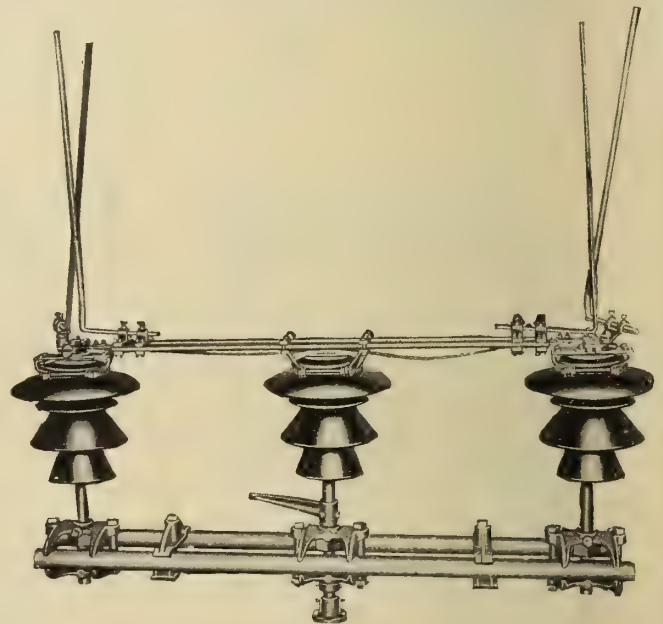
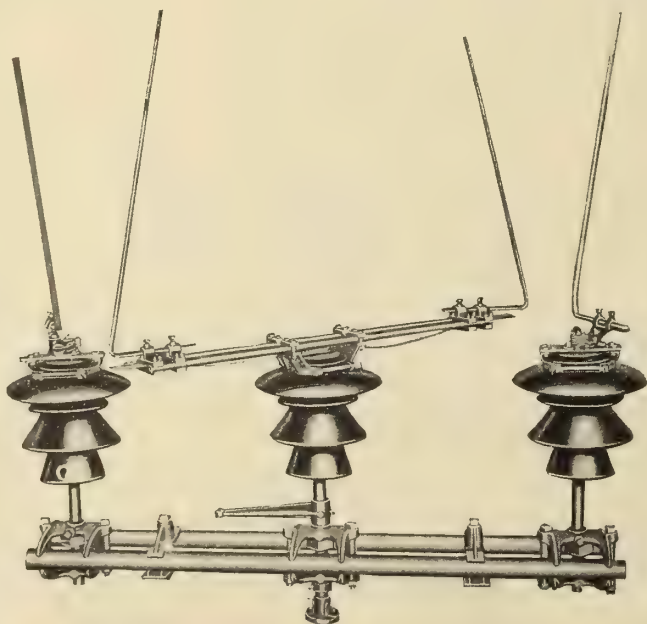
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Vol. 23

Toronto, November 1, 1914

No. 21

## Utility Valuations

No more difficult problem confronts the engineer to-day than that of placing a correct valuation on this or that property required for purchase, expropriation or other purpose. This difficulty is amply evidenced in the wide variation in the figures of different valuations on the same property. That the matter is one of very vital importance in Canada, however, can be well understood when we consider the numerous present-day encroachments of municipal ownership on private utility enterprises and the unfavorable financial situation the private owner finds himself in if forced to accept an inaccurate and inequitably considered estimate of his property.

Inaccurate estimates in the past, let us hope, have been the result of poor judgment and insufficient information rather than with any deliberate intent. Such estimates are, of course, most likely to err on the side of under-valuation, because a large number of elements of which the valuator has no practical experience have entered into the original cost of the plant. The cost of the same plant in two different localities, constructed in different years, or completed over different periods, will vary greatly. Hence, the work of the valuator calls for combined practical, technical and accounting knowledge of the highest order, together with the exercise of good general common sense.

Down in Ohio State they have a public utilities commission that regulates the rates, etc., of the public utility companies. To this end it was necessary that the commissioners have a first-hand knowledge of the value of each property; hence the problem of establishing a proper basis of valuation

at once arose. This problem has been solved, for Ohio at least, by the appointment of a committee on valuation, who have now submitted a report outlining the "Principles which it believes to be sound and practical, as applied to the 'Re-production cost new, less depreciation,' method of valuing a public utility." We reproduce copious extracts from this report on other pages of this issue, believing this matter will be found of value to a large number of readers. As indicating the thoroughness with which the committee appear to have done their work, we may mention the single item of interest on capital "During construction." This item, often forgotten in the estimates, is of considerable importance, especially if the work of construction is much delayed—as it frequently is—beyond the date set for completion.

## Grounding Transformers

Once more the necessity of grounding the secondary side of distributing transformers has been brought home to us in the tragic death of a private resident of St. Catharines, as the apparent result of a short circuit between the primary service wires and the low voltage lines entering the house. After hearing the evidence on both sides, the coroner's jury's finding was that death would not have occurred had the system been grounded as modern practice demands.

In a matter of this sort, it is of course very difficult to lay the blame on the most faulty party. One thing is certain, however,—this man's death is the direct result of somebody's neglect to do his duty. The necessity of grounding is recognized beyond question. Why then was the system not grounded?

On the face of it, the fault would appear to rest with our Governments. If the laws of Ontario or any other Canadian province do not make it sufficiently clear that electric distributing systems shall and must be grounded, then blame for this man's death lies at their door. Again, if the law is defined but not enforced, it is equally difficult to see how the Government can shift the blame. The very fact that a government does not take steps to enforce laws it has made is surely sufficient justification for any citizen believing that this act is a dead letter, and if any of the parties concerned in the St. Catharines tragedy have been acting on this supposition, it is difficult to see how they can be punished, or indeed greatly blamed, at this time.

The situation is one of those, apparently, where it is perfectly plain what ought to be done, but not so plain who ought to do it. The people who understand the situation best are for the most part financially interested and so, naturally, will not, except under pressure, incur heavy expenses and endanger their yearly financial statement for purely humanitarian reasons. On the other hand, of the people who make our laws there are comparatively few who are in touch with matters of such a technical nature.

We would suggest that, in the absence of a Canadian Society of Electrical Engineers, this is a matter for the attention of the electrical section of the Canadian Society of Civil Engineers or for the local sections of the A. I. E. E., and that either, or both, of these might use their influence to advantage. The vital importance of grounding all secondary circuits in distribution work should be brought prominently and persistently before both local and Dominion houses, until such time as present defective installations are corrected, and the lives of our citizens receive, to the full, such protection as the present state of the science of electrical distribution can give. Even then some accidents must occur, for there is still much to learn. But such a measure of protection as can be given a private consumer he should be in a position, backed by the law of the land, to demand.



## What are the Facts?

The free exportation of our nickel ore is making it easy for Germany to obtain a supply of this war necessity for use in manufacturing fire-arms and ammunition. This statement is being heard on all sides. We are sending troops to overpower the Kaiser, and at the same time handing him, with our compliments, the weapons with which to defend himself. The fact that nickel is contraband of war is not sufficient excuse for allowing this free exportation, as, in spite of all the vigilance of the British navy, a certain amount of smuggling must get by, where the demand is so insistent and the chances of profits so alluring. The exportation of nickel from Canada should immediately be limited to the actual industrial necessities of friendly customers, as nearly as this can be gauged, and an error on the side of under-exportation, even for this purpose, would be a matter of comparative indifference at the present moment.

Rumors are afloat that powerful financial interests are responsible for the inactivity of our governments, and even that the influence of certain of these men is rendered all the more effective in that they themselves occupy prominent government positions. This is a matter that will be investigated. It is also said that the famous Krupps, the prime source of German effectiveness today, are heavy shareholders in and actually control the majority of the stock of one, at least, of the more powerful Canadian nickel mining companies. Think of it—under our very nose the German Emperor carrying on, undisturbed, mining operations which in turn feed his foundries, to turn out still more powerful guns and explosives to be used to destroy our own brothers in the field. Is our Government doing everything to stop it? If there is anything in these reports, we and all other Canadians want to know it at once.

## "Money" for Red Cross Society

The Canadian Red Cross Society have issued literature calling attention to their work, and pointing out the necessity for further subscriptions if the work already undertaken is to be developed to its highest point of usefulness. Included in the literature is a booklet entitled "Suggestions for Work," which points out lines along which supplies are most urgently needed. Another pamphlet explains the rules of the society. There is also included an article by Col. G. Sterling Ryerson on the Canadian contribution to the medical services in the great European war. Speaking of the Canadian contingent, Col. Ryerson concludes as follows:—

"It is our duty as well as our privilege to provide for the sick and wounded of this contingent all comforts which may be possible either directly through our own society or indirectly through the British Red Cross Society. To accomplish this we must have first money, with which to purchase the necessary articles which cannot be made at home, to contribute cash to wounded and sick soldiers and to pay the running expenses. Therefore, give as your heart dictates. The widow's mite and the millionaire's cheque are equally welcome, and will be faithfully applied.

"Money and goods should be sent to the Treasurer, Canadian Red Cross Central Committee, 77 King Street East, Toronto, or to the local committees of your district."

## Openings for Canadian Trade

The Canadian Department of Trade & Commerce, in their weekly reports, continue to draw attention to the increasing number of openings for Canadian trade in different parts of the world, as the paralyzed condition of German and Austrian business becomes more fully recognized. The issue of October 19th contains letters from the trade commissioners in South Africa, Australia, New Zealand, West Indies, Trinidad, and other points, all of which are in the same strain, indicating that one of the strongest weapons

against Germany and Austria at the present time is in cutting off not only their present trade, but the possibility of renewing old relationships when the war is over. As indicating the fields now thrown open to Canadian manufacturers, we mention the following:

### South Africa

During the year 1913, out of a total importation of wire and cable of \$375,000, Germany supplied equipment to the amount of \$350,000.

Last year's imports of electrical machinery amounted to \$2,255,000, of which Germany's share was more than half, being valued at \$1,260,000.

### New Zealand

One of the larger items of New Zealand's import trade from Germany is motors and auxiliary electrical materials, to the amount of \$350,000.

### British West Indies

Electrical machinery to the extent of \$30,000 was imported from Germany during the past year.

## The Horse-Power Required per Capita in Cities

By H. E. M. Kensit, Mem. Am. I. E. E.

Engineers frequently require for estimating purposes to take a figure for the maximum h.p. likely to be required for electric light and power supply in a given city at some future point in its growth and population.

The writer recently had occasion to obtain direct from the officials of a number of medium-sized Canadian cities, particulars as to the maximum h.p. developed at the municipal electric light and power works and the estimated population at the same time. Cities were chosen for the enquiry where there were no unusual conditions or circumstances, where there was no alternative or competitive supply and possessing about an average number of miscellaneous industries.

The generally accepted figure for such an estimate is one-tenth of a horse-power per capita and the result of this careful enquiry so closely confirms this figure as an average result that it is thought the particulars shown on the accompanying table may be of interest to other engineers.

The figures given are for the actual maximum load on the central station and do not include reserve plant or private power installations.

Electric Power Demand  
Peak Load on Municipal Power Plants.

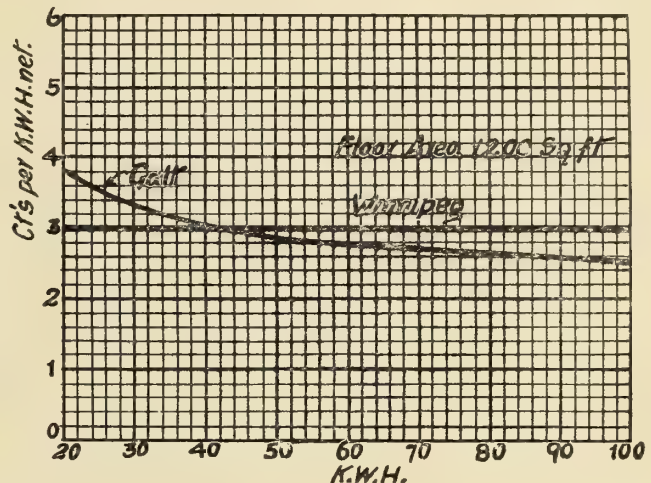
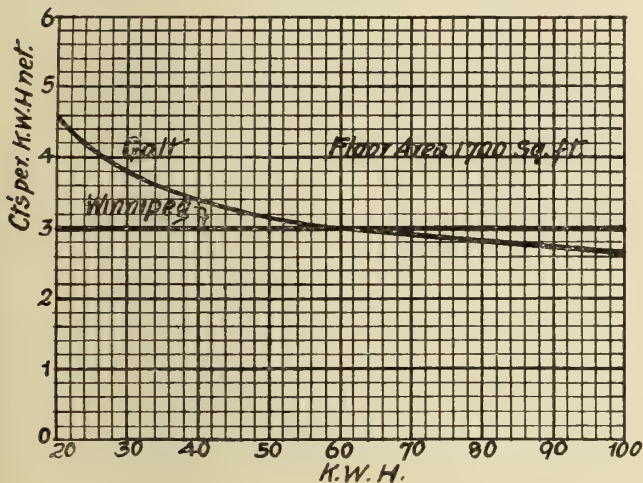
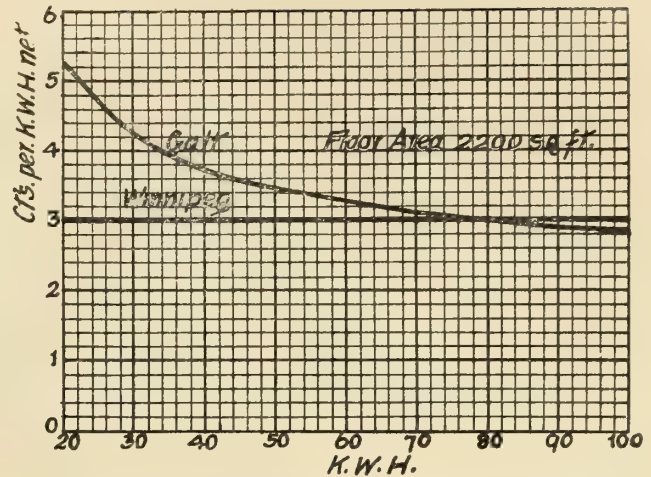
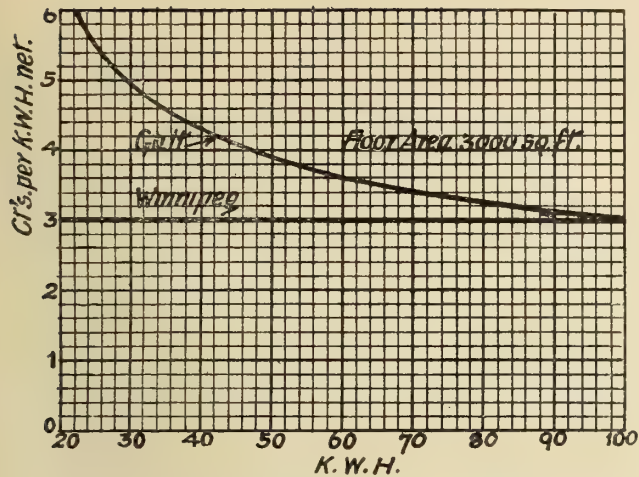
	Location	Population 1913	Peak Load in H.P.				H.P. per Capita
			Lighting	Power	Street Railway	Total	
A	West	60,000	2,680	1,470	3,080	7,230	0.120
B	"	42,000	1,940	670	1,070	3,680	0.090
C	"	75,000	5,100		3,150	8,250	0.110
D	"	29,000	2,500		600	3,100	0.107
E	East	46,000				6,000	0.130
F	West	12,000				820	0.070
G	"	12,000				1,070	0.089

Average ... 0.102

## Lowest Rates in Canada

In our September 15th issue, under the heading "Lowest Rates in Canada," we published, along with a few comparative figures, the new rates just established by the Hydro-electric Power Commission of Ontario in Galt. It is plain, however, as shown in a Winnipeg communication printed below, that Galt has a strong competitor and that the title is not going by default. As shown by the explanation in the attached article, and still more clearly by the accompanying curves, the small consumer in Winnipeg has decidedly the best of the argument. For all consumption up to 40 kw.h.





Showing comparative rates Galt, Ont., and Winnipeg, Man.

per month, the Winnipeg rate is the lowest, and with the larger floor areas it is lower up to 100 kw.h. As it is probably safe to say that the majority of customers who use electric current for lighting purposes use less than 40 kw.h. per month, it follows that, in the majority of cases, Winnipeg rates are lower. If the customer's consumption should get as low as 10 kw.h., the difference is even more noticeable, as, in this case, the Galt rate (say 1,000 ft. floor space) is 27 cents plus 22½ cents, a total of 49½ cents, as against 30 cents in Winnipeg. If a man with a 3,000 ft. floor space economizes to the extent of keeping his consumption down to 10 kw.h., the Galt rate would be 81 plus 22½ or \$1.03½, as against 30 cents in Winnipeg. It would appear, therefore, that on the average account, the advantage is with the Winnipeg citizen. The protest mentioned above reads as follows:—

"Winnipeg challenges the statement made in the 'Electrical News' of September 15th that Galt, Ontario, enjoys the lowest lighting rates in Canada.

"Since January, 1912, the Winnipeg rate for domestic lighting has been 3 1-3c. per kw.h., with 10 per cent. discount for prompt payment. This is a straight meter rate there being no area charge and, on this account, it is difficult to obtain a mutually acceptable basis of comparison. It is, however, possible to obtain approximately accurate figures on average floor area and monthly consumption, as was done by the City of Winnipeg in 1912. Assuming first, conditions most favorable to the Galt rate, let us suppose the floor area of the average private residence to be 1,000 sq. ft. or less. The average area charges, under these conditions, would be 27c. As the difference between the meter rates of Galt and Winnipeg is ¾c. per kw.h. net, it follows, where the monthly consumption is above 36 kw.h., the Galt rate is lower and,

when less than 36 kw.h., the Winnipeg rate is lower. The question, therefore, is whether this figure of 36 kw.h. is high or low. We believe that it is sufficiently accurate to entitle the City of Winnipeg to a claim to at least as good a domestic lighting rate as any other Canadian city. This claim is still further fortified by actual tests, which show averages of 1,700 sq. ft. and 45 kw.h. for floor area and consumption respectively. With a 1,700 sq. ft. residence, the fixed charges being 40c. per month net, the critical point is 61 kw.h. per month or 16 kw.h. more than the average. The Winnipeg rate, therefore, for a residence of this size, would in all probability be less than the Galt rate.

"The difference between these rates is illustrated graphically in curves 1, 2, 3, 4. In curve 1 with a floor area of 3,000 sq. ft., the critical point is 108 kw.h., in curve 2 it is 80 kw.h., in curve 3 it is 61 kw.h., in curve 4 it is 43 kw.h. Winnipeg's claim is that the consumption indicated by the critical points on these curves is in excess of the average consumption, thus proving their rate to be the lower. This claim is of course open to dispute, but, in any case, it must be admitted that the policy of municipal ownership of public utilities adopted by the citizens of Winnipeg has proved a wise one, in so far as it has resulted in a reduction of rates from 10 cents to 3 1-3 cents in the last three years.

"The Winnipeg commercial lighting rate is specially low, being 3 1-3c. per kw.h., with 20 per cent. discount for prompt payment, and additional wholesale discounts from 20 per cent. to 60 per cent., when the bill is over \$25.00. This net rate has at times worked out as low as 1¼c.

"The Winnipeg rate for heating is 1c. per kw.h. with 10 per cent. discount. The power plant is graduated and is subject to wholesale and prompt payment discounts, and a net rate of ½c. per kw.h. has been obtained by large users."



# The Cost of Electricity at the Source

[The June 1st issue of the Electrical News contained an article by Mr. H. M. Hobart on "The Cost of Electricity at the Source," which had been presented shortly before at a meeting of the American Institute of Electrical Engineers. In this article Mr. Hobart places the cost of a steam turbo-generating plant of 100,000 kw. capacity, 5 units of 20,000 kw. each, at \$35 per kw. Where a plant is to be located in or near a large city, this cost is placed at \$40, to make allowance for increased outlay on land and buildings. We print below the discussion on this paper, which has just been published in the Proceedings of the society. For the most part, Mr. Hobart's cost figures are criticized as being too low.—Editor].

## "The Cost of Electricity at the Source"

**J. W. Lieb, Jr.:** I am sure that under the conditions obtaining in our larger cities the figure given by the author, of \$35 per kilowatt of capacity, will not cover the real estate and buildings of a character to satisfy local conditions. The sum of \$35, even if otherwise adequate, which I doubt, would allow the merest shell of a building rather than such a structure as it would be necessary to provide to house a plant of the capacity indicated by the author.

**H. R. Summerhayes:** I ask Mr. Hobart how many days' coal storage is provided for under his plan. In these days of coal strikes and interruptions to transportation it seems necessary to provide a large acreage of land to store a large amount of coal. Such a station ought to require a large area for that purpose.

**H. W. Buck:** There is one advantage which the steam plant has in this comparison. As a rule, the water power plant is many miles from the point at which the power is applied, and the cost of transmission lines, sub-stations, etc., must be added. On the other hand, the steam plant, as a rule, can be located practically at will, and as near as possible to the centre of load. This also applies to operating costs on the transmission system, which the steam plant will not have to so great an extent.

**Frederick A. Scheffler:** I hope that the author of this paper will be more specific in giving us exact data as to how he arrives at \$35 per kilowatt for the cost of constructing a complete 100,000-kw. station.

I would like to know what size boiler units he proposes to use, whether he will use steam turbines, and if so, what size units, working steam pressure, superheaters, if any, and degree of superheat, at what rating the boilers will be operated and what kind of stokers will be used, whether underfed or otherwise, and whether the cost covers economizers.

I have in mind a plant which is being constructed in the West at the present time, of an ultimate capacity of 120,000 kw. The company which is building this plant feels that if it can construct the station, using six 20,000-kw. turbines and twelve 2400-h.p. (nominal rating) boiler units, with superheaters for 200 deg., and operating the boilers at 200 per cent. of rating when necessary, and the cost does not exceed \$55 per kilowatt complete, it will have a very reasonable and inexpensive station, considering its construction, which is to be of the very best throughout.

**H. L. Wallau:** I have only one criticism to make of this paper, and that is the figure of \$35 per kilowatt. That figure has been qualified in this discussion, and it has been qualified as presented by Mr. Hobart. However, in a city such as Cleveland is, the tendency will be for the engineers of the municipality to say, just as soon as a figure of \$35 per kilowatt is published in an Institute paper, that it must be pretty close to the actual cost. Apparently the way they figure

cost in Cleveland in a municipal undertaking, is to take the figures, for instance, published in the Institute Proceedings for a 300,000-kw. plant, and say, "If they can do that in a 300,000-kw. plant we ought to be able to do practically that in our 15,000-kw. plant," and as a result they have published a schedule of rates, with a maximum rate of three cents and a minimum rate of one cent. I believe on last Tuesday they got ready to pass a maximum rate ordinance of three cents, to which they expect us to conform. I think for these reasons, when a statement is made, and a figure is published, that it should be carefully qualified, because the tendency towards municipal ownership is growing rapidly in this country, and the analysts are, I believe, making some very grave errors in their calculations.

**H. B. Alverson:** The load factors given are too high for the usual existing conditions, and while it may not be the intention in the paper to give exact figures, I believe the load factor which will occur in practice will be nearer to 35 or 40 per cent. than to 50 per cent. In such cases the cost per kilowatt-hour would rise somewhat higher in proportion than the figures given. Without going into the calculation of the proportion of costs based on the load factor, I think the average experience is that it is very much higher than that which is given in the paper.

**O. K. Harlan:** Regarding the matter of depreciation, it might be of interest to note that a few weeks ago, before the American Society of Heating and Ventilating Engineers, a paper was presented giving something of the life history of quite a number of the old electric lighting steam-driven plants in this city, and the matter of depreciation was dealt with in that paper. It traces the history of the very earliest installations, including the first steam-driven electric dynamos which were operated in the city. One of the old ones is in the Mills building, and a number of others are downtown, near it. The depreciation was shown to be quite a variable factor; of course, some generators will deteriorate faster than others, and the matter of economy and efficiency is quite an item also; that is to say, some of the more recent generators may be of so much higher efficiency that it is worth while to discard a really good working machine in order to put in a more modern machine of higher efficiency. However, this paper shows that a number of these earlier plants have had a useful life of twenty years; some are really working today, which were installed twenty years ago—but the matter of depreciation, while it is a very interesting subject, is really somewhat intricate, and there are a good many factors entering into the final decision.

**H. C. Abell:** If Mr. Hobart means the \$35 to cover the cost of machinery, water facilities for a plant of that size, storage requirements, working capital, supplies, cost of financing the undertaking, and all the incidental expense, I think unquestionably he used the wrong multiplying factor to arrive at the figure given, which I consider too low.

Another thing which attracts one's attention is the five per cent. interest figure used by Mr. Hobart. I do not know of any money source which could be induced to provide funds for a power-generating plant on a five per cent. basis.

I suppose amortization placed at 4.6 per cent. is a depreciation fund, for a power plant is usually not amortized, but is a continuous business where the owners have to provide funds continuously for new construction after the plant once starts. Amortization is entirely different from depreciation; the two terms should not be confounded.

**A. H. Kruesi:** With regard to depreciation, I believe obsolescence often cuts a much larger figure than depreciation due to wear and tear. I am associated with a large steam-turbine power plant built eleven years ago. The stokers and



their auxiliary equipment are now being scrapped because they are obsolete, though not worn-out. A number of boilers installed seven years ago are also being scrapped because they are of a type no longer manufactured and the allowable working pressure has been reduced, so that they have become unsuitable to their purpose. The entire switching equipment is being replaced after eleven years' use because the plant has grown and it is no longer adequate for the amount of power behind it. I agree with the criticism of Mr. Hobart's paper, on the score of his capital cost charges. I do not see how they could possibly be figured at less than 15 per cent.

**V. Karapetoff:** Mr. Hobart's paper has been criticised on account of the specific numerical data given in it. I know from certain experiences in court testimony that outsiders are only too liable to ascribe to the Institute any data published in its Proceedings, in spite of the well-known fact that the Institute is not responsible for opinions expressed by its individual members. To me, personally, Mr. Hobart's paper is exceedingly interesting and instructive in giving a concrete method of calculation. If he had chosen to use letters, instead of numerical values, I am afraid the paper would be exceedingly difficult to follow, but then it would have been of greater general interest, as any one could substitute numerical values for his particular problem and the above criticism would be obviated.

I was surprised at the statement that the outlay for the turbo-generators, cables, exciters, switch gear, etc., amounts to only 30 per cent. of the total cost of the generating station. It seems to me that engineers in this country ought to be more interested in the Thury system of generation, which, so far, has been mainly applied to hydro-electric stations, but lately was chosen in London for underground distribution from a steam plant. The principal advantage of the Thury system is that not only the cables themselves cost less, but also the generating station is lower in cost; while the generators themselves are more expensive, the cost of auxiliary apparatus is much lower. If one goes into a station like the Northwestern station in Chicago, it is the auxiliaries which strikes one's eye, and it is the auxiliaries which occupy the most room and apparently seem to cost the most.

**G. L. Knight** (by letter): The author of this paper states that a 100,000-kw. steam station, consisting of five 20,000-kw., 60-cycle, 1800-rev. per min., three-phase turbo-generators, together with all the apparatus, both steam and electric, required for the operation of such a plant, can be built in this country for an over-all charge of \$35 per kilowatt.

This paper, being presented before the A.I.E.E., presupposes in the absence of contrary statement that the figures given represent American practice, but in replying to the discussion on his paper in the meeting of February 26, Mr. Hobart defended his estimate by the following figures taken from estimates of plants constructed in England:

	per kw.
Turbo-generators, including exciters and switch gear	\$10.50
Steam raising plant	8.50
Condensing equipment	5.00
Building	8.00
	—————
	\$32.00

This leaves only \$3.00 for the rest of the charges, which must include land, general engineering and construction expense other than that included in the items as given, also all overhead charges during the construction period.

In place of the figures set down by Mr. Hobart, I would give the following as minimum values, and while they will vary greatly according to the conditions a plant must meet, the total cost per kilowatt will be often much nearer \$75.00 than the figure given.

Building	\$10.00
Turbo-generators, including exciters.	\$12.50
Switch gear	3.00
	—————
	15.50

Steam plant	
Boilers	6.00
Stokers	2.50
Flues and piping	2.00
Coal and ash handling equipment	1.50
	—————
	12.00

Condensing equipment	
Condensers and pumps	3.00
Condensing tunnels	2.00
	—————
	5.00
	—————
	42.50

Engineering, drawings, supervision and other overhead expenses, 15 per cent.	6.35
Allowance for piecemeal construction and contingencies, 15 per cent.	6.35
	—————
	\$55.20

To those of us in the employ of public service companies this paper seems at least ill-advised. Regulating bodies and the advocates of municipal ownership are constantly challenging our capital costs, and when a company's books show a cost of \$50 to \$75 per kilowatt for a new plant (and older ones will be even higher), papers such as this are quoted in attempting to prove such costs excessive.

In such cases it is assumed, by those who do not know the Institute rule, that having accepted such a paper for presentation at a meeting, the Institute must have passed on it as being reasonable.

I think Mr. Hobart should have stated that his whole case rested on English figures, and I am inclined to believe that even in England no plant has ever been completed which, when all charges were accounted for, came within his figure at \$35 per kilowatt.

**Frederick G. Strong** (by letter): Permit me to say a word in behalf of our water powers; they seem to have very few friends among those who have discussed Mr. Hobart's paper.

I remember a paper by Dr. Emory, in which the general statement was made that where the cost of water power development exceeded \$150 per horse power a steam-driven plant would be advisable where good coal could be obtained at about \$4 per ton. We have heard, periodically, that a slight increase in efficiency or a slight decrease in the cost of steam-driven machinery, would cause the water powers to be abandoned, or left undeveloped.

We have seen a marked increase in steam efficiency in the past ten years and a marked decrease in cost per kilowatt, due to increased size of units and increased speed and activity of material, but the water powers are still in use. None have been abandoned, and plans are being formulated for the development of many more.

The theory that water powers should be abandoned, or left undeveloped when they show a greater cost than equivalent steam-driven stations, does not seem correct, and I believe the time is not far distant when we will develop every available water power, to the end that the coal supply may be conserved as much as possible.

Undoubtedly the water powers at Holyoke, and Lowell, and Lawrence, and Manchester have cost far more than equivalent steam power, but if those investments were annihilated, does anyone believe that the power would be left undeveloped?

In the energy of falling water Nature has not by any



means given us something for nothing, but it is doubtful if we may expect a nearer approach.

**H. M. Hobart** (by letter): I shall deal with the contributions to the discussion of my paper in the order in which they were made.

As to the first comments which were made by Mr. Lieb, it would appear that his intention is to supplement my paper and emphasize the importance that it should not be construed as applying to stations located in or near large cities. It was clearly shown in my paper that I referred to a station located with especial reference to low cost of land, abundance of circulating water and low price for fuel. This necessarily locates the station at some situation where architectural effect is absolutely out of place. In the recent report made to the London County Council by Messrs. Merz and McLellan, it is pointed out that in modern plants "the power house tends more and more to become a metal structure for housing the machinery rather than an actual building in the usual sense." The savings which can be effected under the conditions which I describe for my plant are inapplicable to a power house located in our larger cities, and I am glad that Mr. Lieb took the occasion to emphasize this point. Furthermore, in city plants supplying electricity for all sorts of purposes to a large community there must be large investments for duplicate switch equipments and for supplying large numbers of feeders. This inevitably runs up the cost, as it does also the need for economizers, which are justifiable under these circumstances, since the price of fuel is relatively high. It was expressly stated in my paper that no outlay for transformers was included, and further, that the estimates related to 60-cycle generating sets. These sets were only five in number, of the most modern type, and were for a rated speed of 1800 rev. per min. In city stations it is often necessary to supply, not only 60-cycle electricity, but also 25-cycle electricity, and furthermore, the stations will usually be found to be equipped with more than one size of generator. Moreover, the average rating of all the generators in the station is usually much below that of the 20,000-kv.a. units on which I based my estimates, and they are driven at lower speeds, as a consequence of which they are larger, more expensive in first cost, more wasteful of fuel, and a greater outlay is required for the attendance upon them. When a given aggregate output is delivered from ten small units, as against five large units, the outlay for wages in the station is decidedly greater. Mr. Lieb considers that the real estate and buildings for a station in our larger cities would not be covered by \$35 per kilowatt of capacity. Taking it at \$40, and including an appropriate allowance for the increased outlay for switch gear and for economizers and transformers, then, with an allowance for engineering and contingencies amounting to 10 per cent. of the total, we arrive at over twice the capital outlay per kilowatt installed that would have been necessary on the same scale of prices for a station complying with the conditions set forth in my paper.

In the matter of Mr. Summerhayes's suggestion that in these days of coal strikes and interruptions to transportation, it seems necessary to provide a large acreage of land to store a large amount of coal, and I would point out that with such locations as that clearly contemplated in my paper, the land could not reasonably be taken as costing more than \$200 per acre. On this basis, the outlay for a site of 50 acres would only amount to \$10,000, which is less than three-tenths of one per cent. of the total capital outlay for this 100,000-kw. generating station. Mr. Summerhayes evidently also had in mind the conditions in large cities, far away from the mines, and I quite agree with him that under these conditions the point which he mentions would be one requiring careful attention.

I fully agree with the point which Mr. Buck makes that the steam plant has the advantage over the waterpower plant, that it may sometimes be located quite near to the centre of the load, thus minimizing the costs in transmitting

the electricity to the customers. However, I dealt with "The Cost of Electricity at the Source" and pointed out that by locating a generating station where the conditions as regards fuel and water supply and cost of land are favorable, electricity can be manufactured for a low price and that industries, the cost of whose product depends largely on the outlay for electricity, would be well advised to realize and take advantage of such possibilities.

I am pleased to be able to comply with Mr. Scheffler's request for more specific data as to how I arrive at the cost of the complete 100,000 kw. station. This is set forth in the following table:

I.—Turbo-generators, exciters, cables and switch gear, but exclusive of step-up transformers...	\$10.50
II.—Boilers, superheaters, furnaces, and stokers, but exclusive of economizers, pumps and piping ...	9.00
III.—Condensers, exclusive of pumps, piping and tunnels ...	2.50
IV.—Pumps, piping, tunnels, valves and traps ...	1.50
V.—Land and all buildings and structures, including machinery foundations, stacks, bunkers and conveyors ...	8.00
VI.—Engineering and contingencies (10 per cent.) ..	3.50

Total cost per kilowatt ... .. \$35.00

Mr. Wallau also points out how important it is that the conditions under which such figures can be reached should be clearly stated. I welcome Mr. Wallau's assistance in helping me to point out the distinction between plants of the size and character which I am discussing in the paper, and such relatively small plants as those to which he refers.

Regarding Mr. Alverson's comments, I show in my paper the cost of electricity for all load factors down to 0.30. It may, however, be of interest to point out that the application of electricity to chemical and certain other industries often permits of much higher load factors than have, until recently, been at all customary, and that decided commercial importance attaches to a knowledge of the costs under such conditions of high load factor. Such applications are usually only practicable when the cost of electricity is very low, and in the near future we shall certainly see such industries purposely located where conditions are favorable as regards plentifulness of water and low cost of fuel and land.

Mr. Harlan makes some interesting suggestions. He calls attention to 20 years as a reasonable life for electrical machinery in many cases. My figures for the investment cost are based on an equivalent life of 15 years.

The next two contributors to the discussion of my paper were Messrs. Abell and Kruesi. It is the opinion of both of these gentlemen that my investment costs are a little too low, Mr. Abell's criticism being that funds can rarely be obtained for a power generating plant at so low a rate of interest as five per cent., and Mr. Kruesi emphasizing the importance of the obsolescence factor. All engineers realize the difficulty of equitably assessing the investment costs, owing to the impossibility of predetermining the obsolescence factor and the great difference in the financial standing of companies embarking upon electricity supply enterprises. I believe that the figures on which I have based the annual investment charges are representative for the case under discussion, but it is obviously important to apply a safety factor which should be inversely proportional to the financial standing of the companies.

I am interested in Prof. Karapetoff's suggestion that my paper would have been of greater general interest had I chosen to employ letters instead of numerical values. My own experience is, however, that the paper would not have attracted attention. It is my experience that papers rarely fulfil any useful mission unless they stimulate discussion.

Mr. Knight puts forward an interesting alternative estimate, regarding which I should like to offer the following



comments. For "turbo-generators, including exciters," Mr. Knight allows \$12.50 per kilowatt. For "turbo-generators, exciters, cables, and switch gear" I gave the figure of \$10.50 per kilowatt. For a city station with its more elaborate provision for switch gear and its large number of feeders, the equivalent allowance would be \$11.50 per kilowatt were five 20,000-kw., 60-cycle, 1800-rev. per min., unity power factor turbo-generators to constitute the equipment. If we turn to page 981 of Messrs. Stott, Pigott and Gorsuch's paper entitled "Present Status of Prime Movers," and published in the A.I.E.E. Proceedings for June, 1914, we find \$7.50 per kilowatt taken as the "average" cost of a 20,000-kw., 60-cycle, 1800-rev. per min. turbo-generator. This would seem to indicate that my figures are conservative for large plants favorably located.

As regards the other items, Mr. Knight's estimates do not differ materially from my own, except that he allows 30 per cent. for "engineering, drawings, supervision and other overhead expenses, piece-meal construction and contingencies" as against my allowance of 10 per cent. for "engineering and contingencies." I quite agree that such items may run up to large values and that for each case they must be separately considered.

The last contribution to the discussion is by Mr. Strong and is to the effect that waterpower should—and will—be developed irrespective of the relative capital and operating costs of the investment, as compared with the equivalent undertaking employing turbo-driven generators. One of the objects which I had in view in writing my paper was to call attention to the liability of misapplication of capital. Large amounts are often invested in waterpower developments running much above \$100 per kilowatt installed and in some cases it could be demonstrated that the greater capital charges more than offset the elimination of fuel costs. Often a steam-turbine station at a favorable site would represent a better investment. But there is the liability that any consideration of a steam-turbine station will be dismissed after very superficial calculations, in the mistaken belief that the investment for the steam station will necessarily be excessive. Fifteen years ago (before the advent of the steam turbine) the case was much more favorable for waterpower as compared with steam.

It is equally desirable to call attention to the related danger that the high efficiency of the internal combustion engine will attract capital, notwithstanding that the generating sets alone will cost at least \$60 per kilowatt and even the fuel cost will be as great with the internal-combustion engine as with the steam turbine with oil at  $2\frac{1}{2}$  cents per gallon and coal at \$3.00 per ton. The outlay for attendance, lubrication, and repairs will be much greater with the internal combustion installation. The misdirection of capital in this way would be checked by the more general realization of the low investment cost associated with steam turbines.

In conclusion I should like to take the opportunity to discuss briefly the factors which have contributed to the rapid progress which has been made toward decreased cost of electricity. There has been of recent years rapid progress in the direction of increased efficiency of prime movers. This has been accelerated by the use of individual sets of very large capacity. Not only have these sets relatively high efficiencies, but the investment cost per kilowatt is relatively low. It is well known that the steam consumption of modern steam turbines is much less than ten years ago, consequently a given capacity of steam raising and condensing plant will now provide steam for a station of much greater capacity than formerly. The methods of firing steam boilers have simultaneously undergone radical changes, so that in addition to the lower investment cost, due to the decreased total capacity of steam raising plant required, there is the further investment gain due to the more intense utilization of the plant. In view of these considerations, there

will be no difficulty in realizing that a given outlay for buildings and machinery will be adequate for delivering much more electricity per annum than formerly.

At the same time it must be recognized that in and near large cities there has been a counteracting tendency to require much finer buildings with much greater attention to architectural effect, and since, as Mr. Lieb has pointed out, the cost of land and buildings may easily be the largest item for such undertakings, any lower investment cost per kilowatt for machinery permits of a much less percentage decrease in the total cost than is obtained in the case of such plants as those to which my paper had specific reference. My paper dealt exclusively with plants of enormous capacity (in this case 100,000 kw.) located under such conditions that the outlay for machinery constitutes much the largest item. Under such circumstances the contrast between a modern plant equipped with machinery purchased at modern prices and the best plant which could be put down ten years ago and which would be of much smaller total capacity, owing to the then relatively small demand for electricity, is marked.

It should, in conclusion, again be emphasized strongly that my estimates do not apply to plants located in or near large cities. On the first page of my paper I called attention to "the great field for electricity for large manufacturing enterprises which can be located near the source of electricity supply." I expressly stated that my costs applied to the manufacture of electricity "in bulk" and "under favorable conditions" and I was very precise in pointing out that my costs did not apply to electricity manufactured in and near large cities.

### Well Merited Promotion

Mr. C. H. Mitchell, C.E., has been promoted to the rank of Lieut.-Colonel and appointed general staff officer on the Headquarters Staff of the first Canadian Contingent. Col.



Lieut.-Col. C. H. Mitchell.

Mitchell is equally well known in military and engineering circles, in both of which he has established a continental reputation.



# Cost of Reproducing Utility Properties

## A Detailed Analysis of the Various Elements that Enter into the Reproduction of any Public Utility—Not Forgetting the Cost of Building Up the "Business"

The cost of reproducing the property of a utility is made up of:

1. The cost of reproducing the plant.
2. The cost of reproducing the business which was attached at the time of the investigation.

The reproductive cost new of such property (both plant and business) means the cost of reproducing the property as constituted at the time of the investigation. The cost of reproducing the property as of a given date should take into account all physical, municipal, industrial, and other conditions existing at that time, which affect the cost of labor, materials, engineering, administration, financing and securing of business, together with all other items which enter into the reproductive cost new of the plant and business as an entirety. Where two or more utilities are operated by a single company, each utility must be valued separately, and the value of any property which is used in common by some or all of the utilities must be apportioned among them in the proportion in which such common property is used by each utility.

The types of units actually in use should be taken, and no theoretical substitution should be made of units of a different type which might be capable of rendering equal service.

The material prices and labor costs to be used should be those on which it would be fair and reasonable to figure in reproducing the property of the utility, making due allowance for market fluctuations and any abnormal conditions. In the case of abnormal conditions affecting market prices, fair prices may be determined by means of a trend curve going back far enough so that the trend price would not be materially affected by going back further. The period for which the trend curve is plotted has no relation to the length of time that would be required to reproduce the property.

In view of the fact that the reproduction of a plant and its business as it exists upon the date of the inventory and appraisal will extend over a considerable period of time, and that construction work will continue to the end of the period, it is obvious that the owner must bear the cost of interest on money expended for reproduction of both plant and business from the time it is raised until such reproduction is complete, and also the cost of insurance and taxes over the same period. In order to arrive at the proper amount of interest, insurance and taxes to be added to the other reproductive costs, it is necessary to estimate the reasonable period which such reproduction of the plant and business will require. This period will be different for different utilities and properties of different size. Due to lack of appreciation of the many elements to be considered in making this estimate there is a general tendency to assume a much shorter period than is in fact required. The period should begin when the proposition is first conceived and follow through all the successive steps to completion along such lines as obtain today.

### OUTLINE OF INVENTORY

It is necessary that the inventory should show the following:

- I. Reproduction cost new of:
  - A. Preliminary work.—(1) Preliminary investigation. (2) Organization of company. (3) Cost of financing. (4) Franchise.
  - B. Physical plant, consisting of,—(1) Land. (2) Rights-of way and water rights. (3) Buildings. (4) Generating or

pumping plant, exchange equipment, etc. (5) Distribution and transmission systems, track, etc. (6) Tools, teams, vehicles, etc. (7) Furniture and fixtures. (8) Working capital: (a) Cash and other quick assets; (b) Stores and supplies. (9) Other items of physical property.

C. Established business.—(1) Cost of organizing and training operating, selling and clerical forces. (2) Cost of selling service. (3) Any other costs of attaching business.

II. Any other elements of going value or goodwill.

III. All other elements of value.

### PRELIMINARY COSTS

There are necessarily certain costs and expenses which precede the work of actual construction of the plant or development of the business of a utility. Such costs cannot be avoided and must be borne ultimately by the company which becomes the owner of the property. In order to appreciate duly the number and extent of these costs, the person appraising the property should begin with the very inception of the idea, and as far as possible estimate all the necessary costs up to the time of the actual work of construction of the plant. Some of these necessary preliminary costs are the following:

1. Preliminary Investigation.—This should include all costs from the conception of the idea to the time of organization of the company, such as investigations as to the feasibility of the project, and similar preliminary expenses; not including, however, promoters' compensation, which is classified under "Organization."

2. Organization.—This should include all fees paid to the state for the privilege of incorporation and all fees and other expenditures incident to organizing the utility. It should include the cost of preparing and distributing prospectuses, cash fees paid to promoters, and the actual cash value at the time of organization of securities paid to promoters for their services in organizing the enterprise, cost of preparing and issuing certificates of stock, bonds or other securities. It should also include legal services required in connection with the drafting of articles of incorporation, by-laws, corporate records of proceedings of directors and stockholders necessary to complete the corporate organization of the company, certificates to the secretary of state, preparing of stock certificates, bond mortgage, and all other documents connected with the issuance of securities, preparing application and securing consent to the issuance of securities, expenses incident to an increase of the capital stock, and expenses of preparing and filing certificates of amendment to the articles of incorporation. This should not include any discounts upon bonds issued, nor any costs incident to negotiating loans or selling bonds or other evidences of indebtedness.

3. Cost of Financing.—This should include brokers' fees, bankers' commissions, underwriting expenses, cost of soliciting subscriptions for stock, and all other costs in connection with raising funds.

4. Franchise.—This should include only the amount actually paid to any municipality or other political subdivision of state or county for the grant of the franchise.

### LAND

That part of the inventory and appraisal which treats of the land owned by the utility should set forth the following data:

#### I. Original Cost

(1) The original cost, including purchase price, or award and expenses of condemnation proceedings; broker's fee;



the cost of surveying and expenses in connection with choice of the site; attorney's fees, and expenses due to any lawsuit in connection with the establishment of lines; abstract company's fees; recorder's fees and expense of registering title; taxes and assessments accrued to date of transfer of title, and all other liens upon the title, when assumed by the purchaser; payments for damages to abutting property and cost of grading land when not done in connection with buildings.

(2) Date and conditions of acquisition, whether by direct purchase, exercise of power of eminent domain, or otherwise.

## II. Value at Some Stated Date

In determining the value of the land to the utility, the Committee is of the opinion that it is proper to consider all expenses necessary in acquiring the land, including purchase price or award and expenses of condemnation proceedings; broker's fee; the cost of surveying and expenses in connection with choice of site; attorney's fees, and expenses due to any law suit in connection with the establishment of lines; abstract company's fees; recorder's fees and expenses of registering title; taxes and assessments accrued to date of transfer of title, and all other liens upon the title, when assumed by the purchaser; payments for damages to abutting property; and cost of grading land when not done in connection with buildings.

## III. Additional Value by Reason of Present Use

If any parcel of land used by the utility is by its location or character especially well fitted to such use, the utility in fixing the value of said parcel should set up under this heading the additional value arising from such special or peculiar adaptability. Thus, for example, in considering the adaptability of a parcel of land for use as a site for a central station, due regard should be given to the following special features which might affect its value:

1. Location with reference to center of distribution.
2. Location with reference to transportation facilities.
3. Suitability of property for future growth.
4. Any other natural advantage, such as availability of supply of condensing water, etc.

## RIGHTS-OF-WAY

This should include the cost of reproducing all rights-of-way acquired for the location of poles, wires, cables, conduits, pipe and track, whether such rights-of-way consist of land owned in fee or of easements acquired by permanent grants or through revocable licenses, oral or written; including the purchase price or award and expenses of condemnation proceedings, the cost of obtaining consents, the salaries and expenses of right-of-way agents and others employed in securing such grants, recorder's fees and all other expenses incurred in the acquisition of such rights. A discussion of these expenses is more fully set forth under Land.

## WATER RIGHTS

This should include the cost of reproducing all water rights, whether acquired through purchases of the fee or through permanent grants or revocable licenses, oral or written; including the purchase price, or award and expenses of condemnation proceedings, the salaries and expenses of persons engaged in securing such grants, recorder's fees and all other expenses incurred in the acquisition of such rights. A discussion of these expenses is more fully set forth under Land.

## BUILDINGS

The cost of reproduction of each building owned by the utility should include:

1. Such preliminary costs as the owner must incur for engineering and architectural expenses pertaining directly to the building in question.
2. The contractor's charge for reproducing the building.

This should be based on one or more competent contractors' estimates, taking into account the entire building

and all permanent fixtures, such as water, steam and gas piping and fixtures; electric wiring and fixtures for lighting, signalling, etc.; elevators; furnaces, boilers, and other apparatus for heating; and permanent foundations for machinery and apparatus.

The contractor's estimate should show quantities and unit prices and should take into account proper and sufficient allowances for delays due to strikes or other causes, contractor's profit, and his costs for money to meet all payments during the course of construction and until all payments have been made by the owner in accordance with the usual plan of payments.

In making his estimate the contractor should not omit those elements of cost which while not apparent in the finished building are necessarily incurred in connection with its construction. The following list will be suggestive of the type of items referred to: demolition of old buildings; general excavations; pits and trenches; pumping and drains; sheet piling and bracing; protection of street and repairs; protection and underpinning of adjoining buildings; cost of estimate; travelling, if any; fire insurance; liability insurance; bond; fees for building permits; water and permits; protection of work; stair guards and lights; rubbish; foundation piles; tests of steel, cement and other material; protection of masonry; cutting and patching; waterproofing; survey and levels; superintendence; temporary office; telephone; photographs; sheds; roadway and planking; temporary toilets; temporary heat; fence; temporary enclosures; watchmen; omissions and contingencies.

3. Architects' and owners' supervision, extras, changes and unforeseen expenses which are paid by the owner and which are not included in the contractor's estimate. In this should be included the cost of grading and sidewalks, fences, hedges, etc., on grounds used in connection with the building, and all other items not specifically included in the contractor's estimate.

## WORKING CAPITAL

Working capital may be defined as the amount of supplies, cash, and other quick assets necessary for the safe, prudent and efficient transaction of a utility's business. It is impossible to lay down any definite rule for estimating the proper amount to be allowed for this item, and this must be determined by each utility with regard to its ordinary outstandings, both payable and receivable, its methods of collections, the natural risk of the business, and the condition of its credit. The allowance should be sufficient to care for emergencies and contingencies as well as the ordinary expenses of operation.

## UNIT COSTS

It is a well-known fact that the plant of a public utility is never constructed as an entirety, or within the theoretical period of construction assumed by the reproductive method of valuation. On the contrary, a considerable portion of every plant is constructed through the gradual addition of extensions and improvements to that portion of the plant which was originally constructed. This experience is ordinarily called Piece-Meal Construction. Examples of such construction are as follows:

In the case of a telephone plant, extensions of lines and installation of drops, etc.; in the case of an electric light plant, similar extensions of lines for the installation of loops and transformers; in the case of an electric railway, track extensions, connections and switches, built from time to time; and in the case of water and gas plants, the extension of mains and the installation of services.

The cost of construction of a plant by the usual method is of necessity greater than the cost of construction of a plant built as an entirety within the theoretical period of construction. It is therefore obvious that in the valuation of a plant, due regard must be given this usual method of construction in the determination of unit costs; and these costs will vary somewhat in accordance with surrounding circum-



stances and conditions. Where practicable, unit costs should be secured from actual day to day performance of the work, and where such data is not available, estimated unit costs should be representative of day to day performance of the work.

The following are the elements which enter into the cost of any unit:

1. Cost of unit f.o.b. point of supply.
2. Cost of purchasing.
3. Cost of inspection.
4. Freight, switching, expressage or cartage to point of delivery, or to utility's store-room or yard.
5. Cost of unloading.
6. Cost of any work at point of delivery, or in shop, store-room or yard, in preparing unit for use.
7. Cost of hauling to point of use, whenever different from point of delivery.
8. Shop, store-room or yard charges.
9. Labor, including expenses of transportation, board and incidentals, and foreman's time and expenses, in performance of all work at point of use, including lost time and delays in work.
10. Tools and appliances.
11. Incidental Material.
12. Breakage, Loss and Waste.
13. Construction superintendence.
14. Employers' liability insurance.
15. Public liability insurance.

The foregoing schedule contemplates that the work will be done by the utility's own organization. Where any work is in practice done by a contractor, all items of expense included in the contractor's price should be substituted in place of similar items covered in the above schedule of unit costs.

#### OVERHEAD COSTS

There are certain general costs, in addition to the direct or unit costs, which every company must incur in the reproduction of its property, including its plant and business, and for which it must make actual money expenditures. These are commonly termed "Overhead Costs," and are of such a character that they cannot be conveniently apportioned to the units of the property. The costs which should be allocated to the units have been outlined under "Unit Costs," and the overhead expenses, which should be treated as a gross sum or apportioned to large groups of units, are described below. However, no hard and fast line of distinction can be drawn, and each utility must use care in the manner in which these items are treated to avoid duplicating in the gross overheads any items which have been allocated to the units. Apportionments among the groups of units may be advisable where one or more of the overheads apply in varying percentages to the various groups of units; but in such case care must be taken that the apportionments are made correctly.

Experience in making appraisals indicates that the following costs should be treated as overheads:

- (1) Legal. (2) Administration and supervision. (3) Engineering. (4) Insurance during reproduction. (5) Taxes during reproduction. (6) Interest during reproduction. (7) Contingencies. (8) Omissions and oversights.

**1. Legal.**—This should include the cost of all fees and expenses paid to lawyers, attorneys, or counsel for services or advice required of them during the reproduction period of the property, that have not been included specifically in any other item. Such services would be the following:

Preparation of franchises, contracts, rights-of-way agreements, and all other documents of whatever nature required by the company in the acquisition of its property and rights.

The adjustment of claims for damages and injuries to persons and property.

Attention to injunction and other cases.

General advice from day to day.

Services in connection with corporate meetings.

Services in negotiations for franchises.

All other legal services.

**2. Administration and Supervision.**—This should include the salaries and expenses of all executive and other officers which are general to the property, and related general expense, such as the salaries and expenses of assistants and clerks, general office rent, and similar expenses necessary in the reproduction of the property, including both plant and business, not already included under Unit Costs or Cost of Reproducing the Business.

**3. Engineering.**—This should include expenditures for engineering, either the fees paid designing and consulting engineers, or the salaries, housing and expense of the engineering force required in preparation of specifications and preliminary and working plans for all construction work; making of cost estimates and reports, and the investigation and determination of proper construction practices; checking of contractors' plans, specifications and bids; checking of work for payments on estimates; testing or inspection for acceptance; and advising on work in progress until completed.

The above does not include the construction engineering work done and allocated to the Unit Costs under Construction Superintendence, Item 13 of Unit Costs; or the engineering during preliminary investigations; or commercial engineering, which is included under the Cost of Reproducing the Business.

**4. Insurance During Reproduction.**—This should include all costs of fire, casualty and any other insurance during the period required to reproduce the property, including plant and business, except such as are included in the Unit Costs.

**5. Taxes During Reproduction.**—As a part of the reproductive cost of its property a utility should include the cost of all taxes and assessments on property during the reproduction period, except assessments for street, sewer and other improvements which are included as a part of the cost of the land.

**6. Interest During Reproduction.**—As it is inevitable that the capital invested in the reproduction of the property, including plant and business, must remain unproductive until the plant passes into service, interest on this capital is one of the necessary costs of reproduction. Interest should be computed on the amounts entering into the cost of the property from the time these funds are required until the plant is placed in service.

**7. Contingencies.**—In spite of due supervision, careful planning and competent management, all difficulties and problems actually encountered in the performance of work can not be entirely foretold and their cost accurately estimated in advance. The character of these contingencies is so varied that it is not possible to anticipate in what form they will arise. Among others there are storms, floods, protracted bad weather, fires, explosions, strikes, riots and civil disturbances. In general practice it is customary to add to all estimates some per cent. allowance under each class of property to cover these contingencies. This should be done in an estimate of the cost of reproduction of the property.

**8. Omissions and Oversights.**—It is the experience of all appraisers that although reasonable care and thoroughness are exercised, it is not practicable to make an inventory and appraisal of a property without unconsciously omitting things which actually represent expenditures. Therefore a reasonable allowance should be included under this heading to compensate for items of property omitted from the inventory. Generally such allowance is covered by a percentage to be added to each class of property.

#### APPORTIONMENTS

Where two or more utilities are operated by a single company, and portions of the plant, transmission lines, distributing systems, or other equipment or property are used in common by some or all of these jointly operated utilities, the value of such jointly used property should be apportioned



among the various utilities in proportion to the service requirements made by each utility upon such property.

Where a single company operates two or more utilities, and maintains a stock of supplies for the benefit of some or all of these utilities, the value of this stock of supplies should be apportioned among the utilities in proportion to the service requirements made upon the total supply by each of the various utilities.

#### COST OF REPRODUCING THE BUSINESS

The reproduction cost of a property embraces not only the physical property, but also all attributes of the property, including its developed earning power. The cost of reproducing the business should therefore be treated as an element in the value of the property. It cannot be separated from the physical property; for example, if the plant is sold, the sale of the property carries with it the patronage and the power to earn. The cost of reproducing the business should not go into the unit costs because it is not a part of the units which these costs cover. Moreover, there is no depreciation of this item to be taken into account. Hence the cost of reproducing the business should include all the necessary costs of attaching the business and reproducing the income of the utility as at a given date. Some of the elements of expense which enter into the cost of reproducing the business are as follows:

1. The cost of organizing and training the operating force, and all employees whose work requires skill peculiar to the business of the utility, such as exchange operators, motormen, conductors, dispatchers, roadmen, signal operators, meter readers, installers, linemen, troublemen, and repairmen.
2. The cost of organizing the clerical force.
3. The cost of organizing and training the selling force.
4. The cost of securing customers, including expenses of solicitors, advertising, printing, free wiring or other inducements.
5. The cost of commercial engineering.
6. The cost of printing all forms, records, books, schedules and directories.
7. The rent of commercial offices (where not owned).
8. Any other cost, not included above, necessary to the development of the business found to exist on the date of the inventory.

#### DEPRECIATION

The term "depreciation" has been variously defined by different writers, depending upon the point from which they view the question, but it is believed that depreciation may properly be defined as the reduction in value caused by physical deterioration and any present obsolescence or lack of utility, if such exists.

Several methods have been used by appraisers in determining depreciation. These methods are:

1. Theoretical Methods.
  - (a) The Straight Line Method.
  - (b) The Sinking Fund Method.
2. The Actual Inspection Method.

**Straight Line Method.**—The Straight Line Method of estimating depreciation is based upon the assumption that the wearing value of a piece of apparatus decreases uniformly from year to year. Hence the method employed is to determine as nearly as may be the life of the unit, divide 100 by the life in years to arrive at the annual percentage of depreciation, and multiply this annual percentage by the number of years the unit has been actually in use. The product is taken as the percentage of accrued depreciation of the unit.

**Sinking Fund Method.**—The Sinking Fund Method assumes that an amount is set aside each year, which, invested at compound interest, will equal the total wearing value at the end of the assumed life. This differs from the Straight Line Method only in that the amount assumed to be set aside annually as an addition to the hypothetical reserve fund

is smaller, due to the compounding of the interest. The depreciation at any time is said by the advocates of this method to exactly equal the amount that is or should be in the sinking fund accumulated in this way.

Both of these methods make use of life tables showing average length of life of similar units. Often these tables do not represent exhaustive studies of any great number of units. Furthermore, unless the life tables are compiled with reference to conditions similar to those surrounding the operation of the unit in question, they are practically worthless as a basis for estimating the length of life of a unit. Frequently such tables are averages taken from records of units operating under widely diverse conditions; hence give no index to the depreciation of a unit working under definite circumstances. Moreover, these tables are based upon studies of units installed many years ago, and operated under conditions prevailing during that period, which are necessarily different from conditions under which similar units are operated today, or will be operated in the future. Moreover, such life tables are open to objection, because they necessarily fail to accurately measure:

1. The wear and tear which has actually taken place on the unit in question.
2. The standard of maintenance employed.
3. The element of inadequacy.
4. The element of obsolescence.

**The Actual Inspection Method.**—The objections which have been urged against estimating depreciation by any of the theoretical methods are met by the use of the actual inspection method. Here the depreciation is determined through actual inspection by an appraiser, and the application of his judgment, verified by such tests as may be practicable. By the inspection method, due allowance is made for the actual wear and tear and the standard of maintenance employed. It is the consensus of opinion that this method affords the fairest measure of depreciation that can be applied to a property.

In the use of this method, it is essential that the appraiser must actually inspect not only the unit as a whole, but the component parts of the unit. From his knowledge and experience he must determine the physical condition of the property or unit with reference to the same property or unit new. In making this determination, the age or length of time that such unit has been in service is immaterial.

For example, two similar units may have been installed in different plants at the same time; the first maintained in the best possible condition, or subjected to light service; the second, neglected or carelessly maintained, or heavily overloaded. As a result, the second unit would be found in much lower physical condition than the first. The respective conditions of these units could be arrived at only by inspection.

A further illustration of the advantage and importance of the inspection method in accurately estimating depreciation, is found in the case of water and gas pipes, and underground conduits and cables. Upon examination, it may be found that in one community or district, irrespective of age, the physical condition of the property may be approximately 100 per cent., while in another community or district, due to peculiar local conditions, there may be found a considerable wasting away of materials. The advantage of the inspection method over any theoretical method for accurately appraising the present condition of property is in this case manifest.

The following suggestions are offered as an aid in arriving at the exact amount or percentage to be allowed for depreciation by the use of the inspection method:

Where a unit has deteriorated, but is capable of being restored to approximately 100 per cent. condition, through repairs or the replacement of parts, the amount of depreciation will be measured by the cost of the repairs necessary to



restore the unit, plus an allowance for any other existing depreciation which cannot be made good by repairs.

For example, a pole which shows rot at the ground line may be reinforced at that point with concrete, and the weakness thereby eliminated. The cost of making these repairs, together with an allowance for any depreciation found to exist in the upper part of the pole, would be the measure of the depreciation.

The cost of restoration is a measure which will be readily applied by the average operator, who is familiar with the expense of repairing units. Or the costs of such repairs may be easily ascertained from the records of the company, or from estimates of competent parties.

In some instances it may be found impracticable to apply this measure, due to the fact that some units do not lend themselves readily to repair. In such cases, the appraiser must, in the exercise of sound judgment, determine the amount of wear and tear that has accrued, and with reference to the remaining service or wearing value, assign a just amount of depreciation to the unit in question.

The value of almost every unit or piece of property may be divided into two parts: (a) wearing value, and (b) scrap, salvage or other remaining value, such as re-use value.

The scrap or salvage value of a unit is its value or its fair market price as old material, after deducting the cost of removal. The difference between the cost of the unit and its salvage value is the wearing value. Since the salvage value as of a date certain is fixed, and therefore not subject to depreciation, the only part of the value of the unit which may be depreciated is the wearing value.

In the case of certain units the scrap or salvage value might be zero, i.e., the cost of removal might equal or even exceed the fair market price of the old material. In such an instance the wearing value and the reproductive cost new would be equal, and the entire reproductive cost would therefore be subject to depreciation.

An example of a unit which has salvage value is insulated copper wire. The value of the copper itself is the salvage; and the wearing value, which alone is subject to depreciation, is the difference between the salvage value and the cost new of the wire in place.

Where a unit has a value to the utility for re-use at some point in its plant, this re-use value should be taken in preference to the salvage value as the point below which depreciation of the unit does not go. To illustrate: A railroad company may use an 80 lb. rail in its main line until it is so worn that it is no longer useful in that place. But while not safe for use in the main line its value for use in a branch line or on a siding may be equal to 75 per cent. of its reproduction cost.

Another illustration is found in the case of a pole of, say 60 feet, which has been in service and has become decayed at the ground line and therefore unsafe. The pole may be removed, shortened, and reset as a 50 foot pole. As reset, it may have a value of from 40 to 60 per cent. of its reproduction cost new.

#### DEPRECIATION RESERVE

Any reserves which any utility may have set up in the past or may set up in the future must not be confused with the actual depreciation of the property.

Depreciation and Depreciation Reserve are two distinct and independent things.

Depreciation has been defined in the foregoing pages.

Depreciation Reserve is a fund set aside in anticipation of the occurrence of depreciation or loss or destruction of any part of the serviceable plant from any cause whatever. It is in the nature of an insurance fund to guarantee the condition of the life of the property and keep it in a condition to render satisfactory service. It is from this depreciation reserve fund that provision must be made to cover replacements made necessary not only by mechanical deter-

ioration, but also by storms, floods, municipal requirements, obsolescence, changes in the art and all other kinds of contingencies which in the nature of things cannot be foreseen.

It is important to note that neither the amount in the depreciation fund nor the amount which ought to be in such fund is in any way a measure of the depreciation or loss of value which has already taken place, nor does it afford a measure of the rate at which depreciation or loss of serviceability will occur in the future.

#### DEPRECIATION OF PRELIMINARY AND OVERHEAD COSTS

The real test as to whether there is or can be any depreciation of such values will depend upon whether in the replacement of any unit the overhead costs must be incurred. Subjecting the overhead and preliminary costs to this test, it is found that the costs of preliminary investigation, organization, financing, franchise, legal, administration, general engineering, interest, insurance and taxes during reproduction do not, upon the replacement of any unit, need to be reincurred to any appreciable extent. Therefore, the depreciation in these values, if any exists at a given time, is so small that it is impracticable to compute it, and the utilities are justified in ignoring it in making up their inventories.

The depreciation of contingencies and omissions may be estimated to be the same as the average for the entire physical property.

## Standardized Definitions

We give below additional standardized definitions as outlined in our issues of September 15 and October 15th. The following list includes many of everyday interest to the operating engineer,—

#### EFFICIENCY AND LOSSES

**Machine Efficiency** is the ratio of the power delivered by the machinery to the power received by it.

**Plant Efficiency** is the ratio of the energy delivered from the plant to the energy received by it in the same period of time,\* the period of time to be suitably chosen.

#### REGULATION

**Regulation.** The regulation of a machine in regard to some characteristic quantity (such as terminal voltage or speed) is the change in that quantity occurring between any two loads. Unless otherwise specified, the two loads considered shall be zero load and rated load and at the temperature attained under normal operation. The regulation may be expressed by stating the numerical values of the quantity at the two loads, or it may be expressed by the "percentage regulation" which is the percentage ratio of the change in the quantity occurring between the two loads to the value of the quantity at either one or the other load, taken as the normal value. It is assumed that all parts of the machine affecting the regulation maintain constant temperature between the two loads, and where the influence of temperature is of consequence, a reference temperature of 75 deg. C. shall be considered as standard. If change of temperature should occur during the tests the results shall be corrected to the reference temperature of 75 deg. C.

The normal value may be either the no-load value, as the no-load speed of induction motors; or it may be the rated-load value as in the voltage of a.c. generators.

It is usual to state the regulation of d.c. generators by giving the numerical values of the voltage at no load and rated-load, and in some cases it is advisable to state regulation at intermediate loads.

**The Regulation of d.c. Generators** refers to changes in

\* An exception should be noted in the case of the efficiency of storage batteries.



voltage corresponding to gradual changes in load and does not relate to the comparatively large momentary fluctuations in voltage that frequently accompany instantaneous changes in load.

In determining the regulation of a compound-wound d.c. generator, two tests shall be made, one bringing the voltage down and the other bringing the voltage up between no-load and rated load. These may differ somewhat, owing to residual magnetism. The mean of the two results shall be used.

**In constant-potential a.c. generators**, the regulation is the rise in voltage (when the specified load at specified power factor is thrown off) expressed in per cent. or normal rated-load voltage.

**In constant-current machines**, the regulation is the ratio of the maximum difference of current from the rated-load value (occurring in the range from rated-load to short-circuit, or minimum limit of operation), to the rated-load current.

**In constant-speed direct-current motors**, and induction motors, the regulation is the ratio of the difference between full-load and no-load speeds to the no-load speed.

**In constant-potential transformers** the regulation is the difference between the no-load and rated-load values of the secondary terminal voltage at the specified power factor (with constant primary impressed terminal voltage) expressed in per cent. of the rated-load secondary voltage, the primary voltage being adjusted to such a value that the apparatus delivers rated output at rated secondary voltage.

**In converters, dynamotors, motor-generators and frequency converters**, the regulation is the change in the terminal voltage of the output side between the two specified loads. This may be expressed by giving the numerical values or as the percentage ratio.

**In transmission lines, feeders, etc.**, the regulation is the change in the voltage at the receiving end between rated non-inductive load and no load, with constant impressed voltage upon the sending end. The percentage regulation is the percentage change in voltage to the normal rated voltage at the receiving end.

**In steam engines, steam turbines and internal combustion engines**, the percentage speed regulation is usually expressed as the percentage ratio of the maximum variation of speed to the rated-load speed in passing slowly from rated load to no load (with constant conditions at the supply). If the test is made by passing suddenly from rated load to no load, the immediate percentage speed regulation so derived shall be termed the **fluctuation**.

**In a hydraulic turbine**, or other water motor, the percentage speed regulation is expressed as the percentage ratio of the maximum variation in speed in passing slowly from rated load to no load (at constant head of water), to the rated-load speed.

**In a generator unit** consisting of a generator combined with a prime mover, the speed or voltage regulation should be determined at constant conditions of the prime mover, i.e., constant steam-pressure, head, etc. It includes the inherent speed variations of the prime mover. For this reason, the regulation of a generator unit is to be distinguished from the regulation of either the prime mover, or of the generator combined with it, when taken separately.

**Luminous Flux** is radiant power evaluated according to its capacity to produce the sensation of light.

**The Luminous Intensity** of a point source of light is the solid angular density of the luminous flux emitted by the source in the direction considered; or it is the flux per unit solid angle from that source.

**Candle.** The unit of luminous intensity, maintained by the National Laboratories of France, Great Britain, and the United States. This unit, which is used also by many other countries, is frequently referred to as the international candle. The Hefner unit is 0.90 of the international candle.

**Candle-Power.** Luminous intensity expressed in candles.

**Lumen.** The unit of luminous flux, equal to the flux emitted in a unit solid angle (steradian) by a point source of one candle-power.

**Illumination** on a surface, is the luminous flux-density over that surface, or the flux per unit of intercepting area.

**Lux.** A unit of illumination equal to one lumen per square meter. The C. G. S. unit of illumination is one lumen per square centimeter. For this unit Blondel has proposed the name "Phot." One milli-lumen per square centimeter (milliphot) is a practical derivative of the C. G. S. system. One foot-candle is one lumen per square foot and is equal to 1.0764 milliphot. The foot-candle is the commonly employed unit of illumination in English speaking countries.

**Coefficient of Reflection.** The ratio of the total luminous flux reflected by a surface to the total luminous flux incident upon it. It is a simple numeric. The reflection from a surface may be regular, diffuse or mixed. In perfect regular reflection, all of the flux is reflected from the surface at an angle of reflection equal to the angle of incidence. In perfect diffuse reflection, the flux is reflected from the surface in all directions in accordance with Lambert's cosine law. In most practical cases, there is a superposition of regular and diffuse reflection.

**Performance Curve.** A curve representing the behavior of a lamp in any particular (candle-power, consumption, etc.) at different periods during its life.

**Characteristic Curve.** A curve expressing a relation between two variable properties of a luminous source, as candle power and volts, candle-power and rate of fuel consumption, etc.

**Mean Horizontal Candle-Power** of a lamp,—the average candle-power in the horizontal plane passing through the luminous center of the lamp. It is here assumed that the lamp (or other light source) is mounted in the usual manner, or, as in the case of an incandescent lamp with its axis of symmetry vertical.

**Mean Spherical Candle-Power** of a lamp,—the average candle-power of a lamp in all directions in space. It is equal to the total luminous flux of the lamp divided by  $4\pi$ .

**Mean Hemispherical Candle-Power of a Lamp** (upper or lower),—the average candle-power of a lamp in the hemisphere considered. It is equal to the total luminous flux emitted by the lamp in that hemisphere divided by  $2\pi$ .

**Mean Zonal Candle-Power** of a lamp,—the average candle-power of a lamp over a given zone. It is equal to the total luminous flux emitted by the lamp in that zone divided by the solid angle of the zone.

**Incandescent Lamps, Rating.** It is customary to rate incandescent lamps on the basis of their mean horizontal candle-power; but in comparing incandescent lamps in which the relative distribution of luminous intensity differs, the comparison should be based on their total flux of light measured in lumens, or on their mean spherical candle-power.

## Conduit Work in Montreal

The city of Montreal is fortunate in being able to continue the construction of its underground conduits. When the financial skies became clouded as the result of the European war, the Council found it necessary, owing to shortage of funds, to temporarily abandon the work, thus throwing many men out of employment. The contractor, Mr. G. M. Gest, made an offer to the Council to continue the construction work and defer settlement until June, 1915, which offer was accepted. By this means the work is being carried out at a favorable time and necessary employment is being given to several hundred men, many of whom would otherwise be idle. Such an arrangement is strongly to be commended, and we congratulate the city of Montreal, and likewise Mr. Gest for his enterprise.



# Electric Railways

## Selecting Railway Motor Equipments

By J. F. Layng\*

The following article furnishes outlines of several calculations which have been selected for the purpose of emphasizing the importance of a complete appreciation of all the governing factors (especially the so-called minor ones) which must be considered when figuring on a railway motor equipment that is to fulfill given conditions. Each new railway problem entails the satisfying of a great number of complex factors and if it does not receive the most minute attention, the best results are not likely to be attained. The author of this article, therefore, points out briefly the effects of local conditions and the characteristics of apparatus which must not be overlooked in calculations.—Editor.

When selecting railway motor equipments it is necessary to have a definite picture of the service or of the work to be performed in order to choose a motor of the proper size and correct gearing, for successful performance. Sometimes the failure to appreciate what schedule speeds, maximum free running speeds, stops per mile and car weights mean, causes electrical equipments to be purchased which are either too large or too small. Consequently in some cases an equipment that is more expensive either in first cost or in maintenance than is required is purchased.

To make any schedule speed with a certain number of stops per mile, there is one definite free running speed that will perform the service most economically, not only in regard to power consumption, but also with reference to the size of equipment selected. The variations in the amount of power required for a car operating on free running speed can be illustrated by taking a 40-ton car as an example: When running at constant speed on level tangent track at twenty miles an hour, this car will require 23.1 kw. input. Providing this speed is increased to thirty miles an hour under the same conditions, this car will take 44.1 kw., and at forty miles an hour 76.2 kw., at fifty miles an hour 124 kw., and at sixty miles an hour 188 kw.

It can readily be seen from these figures that an increase in free running speed, which will bear a certain relation to an increase in schedule speeds, shows a very rapid increase in power consumption, and consequently a much larger equipment is required as the faster speeds are approached. Of course the longer the time that can be allowed to perform a certain schedule the smaller will be the equipment, and the cheaper will be the operation.

It is frequently found when investigating service conditions that the stops per mile made by any equipment vary widely from estimates based on superficial observation. The answers that will be given by different train crews as to the number of stops which they make on a particular trip will be surprising, unless they are especially requested to keep an actual record. Frequently answers to this question vary by more than 100 per cent. for the same run. The number of stops per mile in interurban work is a much more deciding factor than in city work. In city service, where eight to nine stops per mile are made, variation in the number

does not so seriously affect the size of the equipment. The reason for this is obvious from the following: Suppose a car is operating on an eight mile per hour schedule, with ten stops per mile, within an hour it would make a total of eighty stops. With stops of 10 seconds this would mean that the car was standing still for 13.35 minutes, or 22.2 per cent. of the total time. Providing the same car is making nine miles per hour, and six stops per mile, the car would be standing still 9 minutes of the time, or 15 per cent. Strange as it may seem, if the stops per mile were sufficiently great, and the schedule speed were reduced, the size of the motor could be greatly decreased.

The information which it is necessary to have in selecting a car equipment is as follows:

1st, Car weight without live load, but including all equipment accessories, except the electrical equipment, which can be added by the engineer.

2nd, Seating capacity.

3rd, Schedule speed.

4th, Stops per mile.

5th, Length of stops.

6th, Grades.

7th, Voltage.

8th, Diameter of wheel.

9th, Layovers either ends of line, or at any point during the run.

Providing cars are to operate in a mixed city, suburban and interurban service, the data insofar as actual running time, number of stops, and length of stops are concerned should be divided into zones. Securing the information in this way makes it possible to have the proper calculations made for the equipment to be selected. The choosing of a proper motor equipment must be based on experience, and is not simply a mathematical calculation which can be determined by a fixed formula.

Frequently a motor will be selected that can be geared to give the schedule requirements, but the heating may be excessive, or vice versa, the motor being too large for the service, and it will be found that a smaller and consequently lower cost equipment could be chosen for the service.

Manufacturing companies in every case make careful calculations to determine positively that, insofar as the data as presented are concerned, the correct equipment is furnished. Assume that we are to select a motor for city service, on which the general data are as follows:

Car weight complete with all equipment...	42,000 lb.
Live load .....	6,000 lb.
Schedule speed .....	10 m.p.h.
Stops per mile .....	7
Length of stop .....	10 sec.
Average voltage .....	500
Diameter of wheels .....	33 in.

By taking the total weight of car, including the live load, it will be found we have 24 tons. Provided the grades are more than 5 per cent., ordinarily a four-motor equipment would be selected. If this is the case we should have a weight of 6 tons per motor.

\*In General Electric Review



In starting an equipment there is a retardation due to the rotary elements, which is commonly figured at 7 per

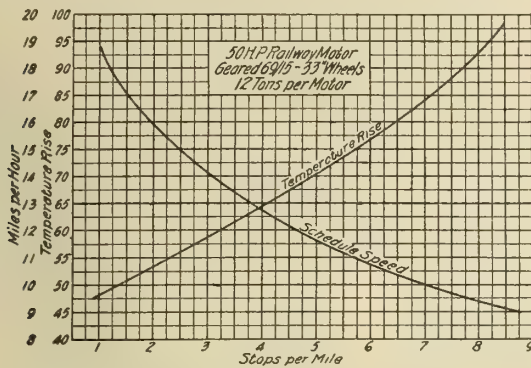


Fig. 1. Effect of Stops per mile on schedule speed and temperature for 50 h.p. motor

cent. additional to the car weight. In this particular case this addition would make a total of 6.42 tons per motor. Previous experience shows that this weight of car in the schedules specified, could be successfully handled by 40 h.p. 600 volt motors having a gearing of 67 to 14.

As a rule city cars accelerate at  $1\frac{1}{2}$  miles per hour per second. For the purpose of the trial calculation we will assume that accelerating  $1\frac{1}{2}$  miles per hour per second will give the desired schedule speed. In order to accelerate one ton at one mile per hour per second, 91.1 lb. per ton tractive effort are required. It can therefore be seen that if we desire to accelerate at  $1\frac{1}{2}$  miles per hour per second 137 pounds tractive effort will be required.

If we refer to the characteristic curve of this motor it will be seen that this will require, for the car weight which we have selected, 1026 lb. tractive effort, or 61 amperes input. This ampere input is approximately the hourly rating of the motor, and should, of course, produce satisfactory commutation. Generally speaking it is not good practice, insofar as calculations of schedules are concerned, to have a motor accelerate much in excess of its hourly rating, unless the motor has been specially designed to have a sufficient margin in commutation. With the tractive effort definitely determined from the characteristic curve, it is a simple calculation to find what will be the maximum speed attained with this particular input and the time required to attain this speed. From the average speed and time the distance is readily figured.

After the car has reached the speed corresponding to this first calculation the current gradually decreases, and the increments of speed, time and distance are simply a matter of continued calculation to a point where it is deemed best to throw off power, and coast or brake. The usual rate of braking for a city service is  $1\frac{1}{2}$  miles per hour per second. The first figures may show that the calculations with power on have been carried either too far or too short to give the required distance and schedule speed. Usually it is necessary to make several calculations in order to get the values for time and distance, to make the schedule desired. Curves and grades greatly influence the calculations, but to explain the different allowances to be made for them would complicate the discussion, and therefore the explanation has not been included.

Providing the information which we have previously mentioned is given correctly, and the service is actually performed as outlined, it is possible to calculate the actual temperature rise of the different parts of the motor within 2 or 3 degrees. This fact has frequently been proven by actual test in service.

From the figures which have been made to find the speed from the characteristic curve all the different losses in a motor can be definitely determined. These consist of copper losses, iron losses and friction. The sum of these

three losses determines the heating for any particular motor.

With closed motors, in making calculations for temperatures, allowance should be made for differences in schedule. A motor when tested on a test stand at the factory will radiate a certain amount of heat. When operating on a car with a schedule speed of 10 m.p.h. this same motor will run approximately 10 per cent. cooler. If the schedule speed is increased to twenty m.p.h. it will run approximately 18 per cent. cooler than if it were tested upon the stand. With ventilated motors the temperature is directly affected by the armature speed, and much greater cooling is obtained. This greater cooling is not only realized in interurban service, but also in slow speed city service. Improvements in methods of ventilation will greatly increase this difference.

Fig. 1 shows the effect of stops per mile on schedule speed and of temperature in the case of a 50 h.p. motor. This particular curve is based on a car weighing 12 tons per motor, 550 volts (average), 33 in. wheels, 69/15 gearing and no coasting. With cotton insulation it is not advisable as a rule, to run motors much in excess of 65 degrees C. rise. By making slightly more than 4 stops per mile with a 12.6 m.p.h. schedule it can be seen that the particular motor in question will have a temperature rise of 65 degrees. Providing the stops per mile are increased to 8, the schedule speed will necessarily fall to 9.4 m.p.h. and the temperature rise will increase to  $92\frac{1}{2}$  deg. C. This excess in temperature rise indicates the necessity for correctly stating the service conditions. Providing the car weight had been reduced to a reasonable limit, the equipment would not only

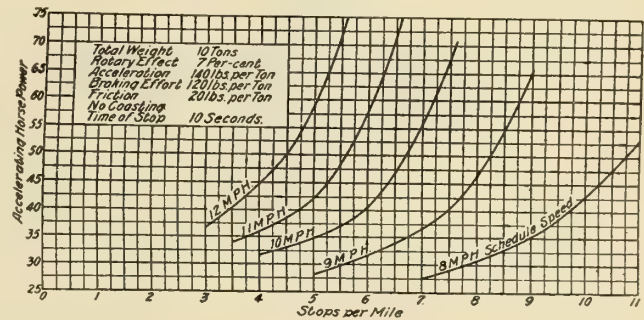


Fig. 2. Accelerating Horse power for 10-ton car

be capable of making faster schedule speeds, but would also have a reasonable temperature rise.

Fig. 2 shows the accelerating horse-power in different services for a car having a total weight of 10 tons, and illustrates the effect that stops per mile on this car will have on a required input. With 12 m.p.h. schedule and 3 stops per mile, 36½ h.p. is required to accelerate this weight at approximately  $1\frac{1}{2}$  miles per hour per second. Providing the same schedule speed is maintained and the car makes  $5\frac{1}{2}$  stops per mile, 72½ h.p. will be required. With a 9 m.p.h. schedule and 5 stops per mile, 28 h.p. will be required. If the stops are increased to 8 per mile with the same schedule, 46½ h.p. will be required. With an 8 m.p.h. schedule and 7 stops per mile, 27½ h.p. will be required. If the stops are increased to 10 per mile, 43 h.p. will be required.

The second curve illustrates the effect of schedule stops per mile on a certain weight of car. The variation of the service requirements shown on this curve illustrates the variation in horsepower required to accelerate cars having a weight of 10 tons per motor, and shows how careful we should be in getting together the facts for the purchase of equipments.

The facts as brought out in this article are intended to illustrate the real necessity for securing accurate service data and the realization that the points which are necessarily covered, while apparently very simple factors in determining the most economical equipment that will give satisfaction in the work it is intended to do.



# Illumination

## Model Lighting Specifications

By Mr. Geo. J. Beattie

[Editorial note—In our issue of September 1st, we printed, in connection with an average size house of which the general ground plans were shown, a set of model plans and specifications for the wiring of this house for light and such



Type No. 1

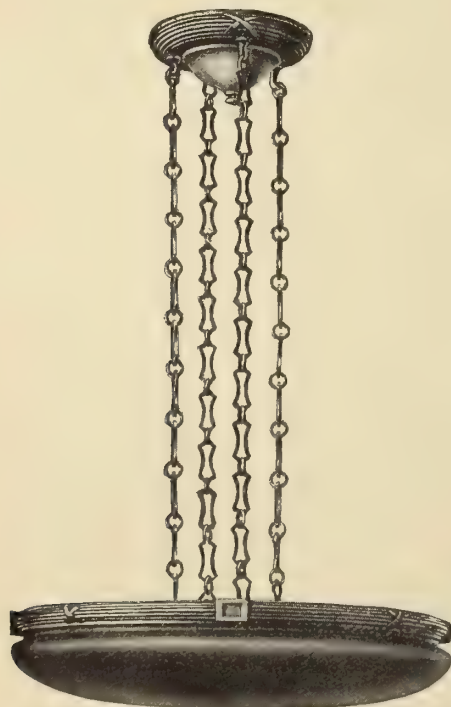
power equipment as is nowadays considered necessary in the modernly equipped residence. This was followed on October 1st by a typical set of plans and specifications for the illumination of the same residence, the wattage being calculated having in mind the use, to a very considerable extent, of semi-indirect glassware. As the type of fixture that may be

installed in such a home varies widely and, with it, the wattage necessary, we print below a further lay-out for the same residence. In the present case, the author evidently favors the indirect type of fixture.]

In recent issues of the Electrical News, there have been printed a typical set of plans and specifications for the wiring of a given residence of average size, and also a set of plans and specifications covering the illumination. In the present article, I wish to outline another typical selection of suitable fixtures and the necessary specifications. It will be noted that the use of indirect lighting is recommended for such spaces as the living room, dining room, reception hall, study and bed rooms. In the home, comfort is the prime requisite, and hence the illumination, in such rooms as the above in particular, should be selected with perfect comfort of vision as the chief consideration. Since experience, as well as the investigations conducted by prominent psychologists and illuminating engineers, have convincingly shown that the most comfortable artificial light is the indirect system, it should receive first consideration in the lighting of the home.

### Specifications

These specifications are intended to cover the supply of all necessary material and labor for the installation of the



Type No. 2



Type No. 3



Type No. 4





Type No. 5



Type No. 6

lighting fixtures complete in all details, in the new residence for \_\_\_\_\_ Toronto.

#### Working Conditions

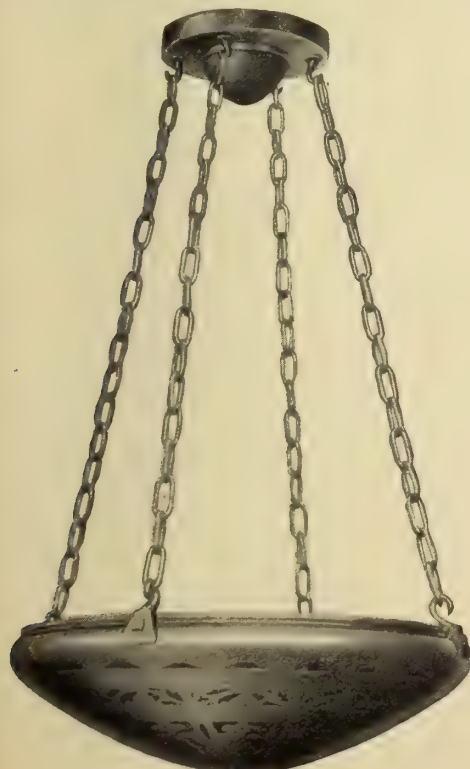
The house will be ready for fixtures in approximately \_\_\_\_\_ days. The Contractor must be ready to install all fixtures as soon as the interior plastering, finishing, etc., is completed, and must cause no delay in the completion of his work.

#### Plans

Plan No. C-38 shows the location of the outlets at which fixtures must be installed. (This plan shown in issues of September 1 and October 1).

#### Schedule of Fixtures

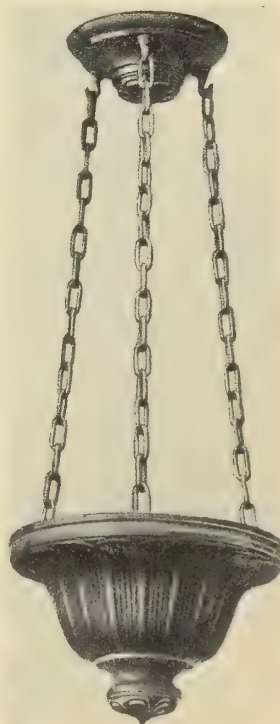
The accompanying schedule of fixtures gives the number and type of fixtures, reflectors, lamps, etc., to be installed in the various rooms, and forms an integral part of these specifications.



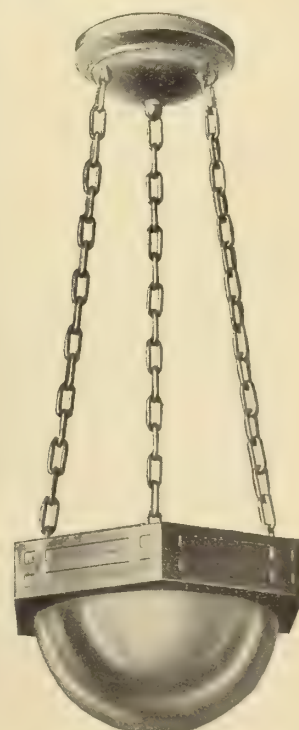
Type No. 7



Type No. 8



Type No. 9



Type No. 10

#### Fixtures

All fixtures must be constructed of the material and finish specified, and in accordance with all rules and requirements of the National Board of Fire Underwriters.

#### Direct Lighting Units

All direct lighting fixtures must be constructed so that they may be supported from a  $\frac{3}{8}$ -in. crowfoot. No other method of support will be permissible. The metal used shall not be less than No. 20 U. S. gauge. They shall be equipped with the type and size of shade holder specified. Where opal glass shades or reflectors are called for, a medium density opal glass is desired. The contractor will be required to furnish samples of the glassware he proposes to furnish to the architect for approval.

#### Indirect Lighting Units

The designs of the indirect bowls are suggestive. The contractor may furnish his own design of fixtures, but they should correspond to the specifications as regards general shape of bowl, size, and method of suspension, and must be submitted to the architect for approval.

Each fixture must be equipped with individual mirrored reflectors—X-Ray eye comfort, or equal—of the size and shape specified for each lamp, and the necessary interior equipment consisting of receptacles, holders, centre bodies, nipples and all requisite accessories, specified in the accompanying drawings and schedule.

Spun and stamped brass bowls shall be made of not less than No. 18 U. S. gauge metal.

Compo. bowls shall be made of a durable composition, which permits of being cast in artistic forms, and has a tough surface, which will take the finishes specified.

Glass bowls shall be a light density opal glass. Samples shall be submitted to the architect for approval.

#### Lamps

All lamps will be furnished by the proprietor.

#### Installation of Fixtures

The contractor will be required to install all fixtures at the outlets specified in the accompanying schedules and

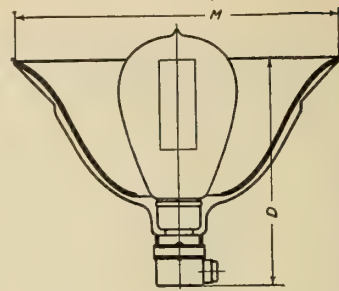




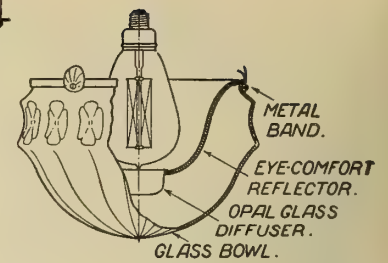
Type No. 11



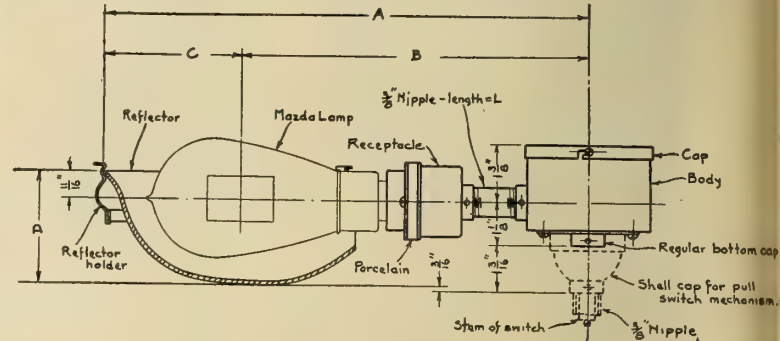
Type No. 12



No. 8018



No. 8018B



No. 7012

No. 7012B

No. 7052

plans, and will be responsible for testing out the circuits, and making proper connections.

The contractor must install all necessary lamps to complete the installation. Lamps will be delivered to the premises in good condition by the proprietor. The contractor will be held responsible for lamps during the installation.

The inspection engineer must be notified in writing as soon as contract is completed. Within thirty days after notification, the engineers will issue a final certificate of acceptance if on inspecting the work, it is found complete in all respects.

#### General Conditions

The same general conditions pertaining to the wiring specifications for this building shall be considered an integral part of these specifications.

The assistance rendered by the telephone in the operation of a large number of camps and drives by one central

head is really remarkable. All parts of the work are constantly in touch with the manager and with each other. In place of a man walking or driving miles with the manager's instructions for a foreman, the manager or agent can call the foreman to the wire and then, after hearing the facts of the case from this man, can issue his orders direct.

A bill has been reported to Congress, recommending the government purchase and operation of the street railways in Washington.

#### SCHEDULE OF FIXTURES

SCHEDULE OF FIXTURES														REMARKS
ROOM	CEILING HEIGHT IN IN FEET	No. REQ'D	FIXTURE		FINISH	LAMPS PER FIXT.	SIZE WATTS	REFLECTOR			INDIRECT LIGHTING			
			TYPE	MATERIAL				GLASS WARE	SHADE- HOLDER	SUS- PENSION ↑ Ceiling band	TYPE No.	INTER. EQUIP'T	SUS- PENSION ↑↑	
BASEMENT—														
Laundry.....	7 ft. 0 in.	2	1	Brass	Bauer Barff	1	40	Opal glass	2¼ 0	“				
Hall.....	7 “ 0 “	1	1	Brass	Bauer Barff	1	40	Opal glass	2¼ 0	“				
Storage.....	7 “ 0 “	1	1	Brass	Bauer Barff	1	40	Opal glass	2¼ 0	“				
Furnace.....	7 “ 0 “	1	1	“	“	1	40	Opal glass	2¼ 0	“				
GROUND FLOOR—														
Front Veranda.....	9 ft. 1 in.	1	12	Copper	Copper	1	40	R.I.	3¼ 0	“				Glass ball
Living Room.....	9 ft. 1 in.	1	2	Compo.	Roman gold	3	150				E155	7052	30 in.	
Entrance.....	9 “ 1 “	1	12	Copper	Copper	1	40	R.I.	3¼ 0	“				Glass ball
Lower Hall.....	9 “ 1 “	1	3	Brass	Antique brass*	1	100				E100	8018	30 in.	
Upper Hall.....	8 “ 7 “	1	3	“	“	1	100				E100	8018	30 in.	
Landing.....	8 “ 7 “	1	3	“	“	1	60				E100	8018	30 in.	
Dining Room.....	9 “ 1 “	1	4	“	Oxydized silver	4	60				E60	7012A	30 in.	Glass bowl
Rear Veranda.....	9 “ 1 “	1	12	Copper	Copper	1	40	R.I.	3¼ 0	“				Glass ball
Coat Room.....	9 “ 1 “	1	5	“	White enamel	1	25	Opal glass	2¼ 0	“				Pull socket
Kitchen.....	9 “ 1 “	1	6	“	“	1	60	“	2¼ 0	“				
Pantry.....	9 “ 1 “	1	5	“	“	1	25	“	2¼ 0	“				Pull socket
SECOND FLOOR—														
Study.....	8 ft. 7 in.	1	7	Brass	Antique brass	4	60				E60	7012	24 in.	
Bed Room No. 2.....	8 “ 7 “	1	8	“	“	1	100				E100	8018B	24 in.	
Closets.....	8 “ 7 “	7	5	“	White enamel	1	25	Opal glass	2¼ 0	“				Pull socket
Bed Room No. 1.....	8 “ 7 “	1	8	“	Antique brass	1	100				E100	8018B	24 in.	
Bed Room No. 3.....	8 “ 7 “	1	8	“	“	1	100				E100	8018B	24 in.	
Sun Room.....	8 “ 7 “	1	9	“	“	1	100				E100	8018	24 in.	
Bath Room.....	8 “ 7 “	1	6	“	White enamel	1	40	Opal glass	2¼ 0	“				
Toilet.....	8 ft. 7 in.	1	6	Brass	White enamel	1	25	Opal glass	2¼ 0	“				
ATTIC—														
Bath Room.....	8 ft. 0 in.	1	6	Brass	Brushed brass	1	40	“	2¼ 0	“				
Bed Room No. 4.....	8 “ 0 “	1	10	“	“	1	100				E100	8018	18 in.	
Bed Room No. 5.....	8 “ 0 “	1	6	“	White enamel	1	100				E100	8018	18 in.	
Hall.....	8 “ 0 “	1	11	“	Brushed brass	1	25	Opal glass	2¼ 0	“				Pull socket

† Bottom of Reflector to Floor.

†† Top of Bowl to Ceiling



# The Dealer and Contractor

## The Electric Christmas Gift

**There is no More Satisfying or Educational Toy Than the Electric—Make it an Electrical Christmas for Men, Women and Children**

Every boy longs for mechanical toys. At Christmas time he wants them worse than at any other time of the year—and gets them. Why not electric toys? There is probably not a single Canadian boy who would not shout "electric" if he had his choice. Are the dealers taking full advantage of this very natural and laudable inclination?

The objection to electric toys in the past has been in part their cost, in part the prejudice against them as a possible source of danger, and in part that they required skill to operate beyond that possessed by the ordinary boy. These objections do not hold today. Prices of electric toys compare very favorably with those of other kinds of Christmas joy makers; the danger element, if it really existed, has been entirely removed and the manufacture of even the cheaper forms has reached such a high degree of mechanical perfection that the skill required to operate and keep these toys in repair is reduced to a minimum.

And then, what about the advantages? Electric toys are pre-eminently clean and tidy. They are now so constructed that they outlast, many times, most other forms of mechanical toys. They are a keen source of pleasure (rather than amusement), even to the older members of a family, who enjoy them equally as much as the boys themselves, and—last and best—they furnish one of the most effective means of developing the boy's mind and giving him an insight into what is going on in the big world outside.

Unfortunately, perhaps, it is still the custom of the parents to buy the Christmas toys, and in their conservative wisdom such new-fangled things as electricity must give place, as yet, to rocking horses and express wagons. The next generation will undoubtedly view these matters differently, but in the meantime, a great deal more can be done towards displaying and demonstrating electric toys and other Christmas electric novelties and in pointing out their many advantages.

It is with the idea of assisting somewhat in this educational campaign that we reproduce herewith a number of cuts suggestive of Christmas possibilities in the way of electrical presents for children. The cuts, of course, are only typical and represent the merest fraction of what is available nowadays. It is high time, however, that the dealer should make his choice and place his orders, as the next two months will roll away very quickly. In spite of the war and other depressing conditions, it is doubtful if Canadian children will find themselves much neglected when they come to examine their stockings on Christmas morning. It is reasonable to expect, however, that the tendency will be towards purchases of more useful gifts and this is just where the electrical toy and all the other efficient electrical appliances will have a chance to demonstrate their particular applicability. Merely as suggestive, we publish a list below of toys and novelties any one of which may well

find a place on the list of every father and mother starting out to make their Christmas purchases.

Telegraph instruments	Medical batteries
Wireless outfits	Electric magnets
Permanent magnets	Electric bells
Electric motors	Electric dynamos
Flash lights	Miniature railways
Christmas tree outfits	Toy transformers
Electric automobiles	Electric aeroplanes
Radiopticon	Electric switches
Utility motors	Electric questioner
Electric tops	Electric power houses
Rotary transformer	Electric locomotive
Electric railway accessories	Electric lamps
Electric hoists	Electric derricks
Electric windmills	Electrically-operated bridges
Electric vibrators	Electric night clocks
Flash lights	Electric flying machines
Electric signals	Electric scarf pins
Electric pen illuminater	Aerial swing
Ferris wheel	Merry-go-round
Toy X-ray outfit	Miniature static machine
Toy water power plant	Electric corn popper
Storage batteries	Dry cells
Electric bicycle lanterns	

Outside of the field of mere toys, the list of Christmas presents which may well be offered to the judicious purchaser during the next couple of months is a very lengthy one. In the hope that it may prove of assistance, we print a fairly complete list below. There is no single item mentioned that will not take its place in the daily life of a man or woman, adding both pleasure and comfort. It would scarcely be possible to compile any other such list of suggestions that would compare with it in utilitarianism and luxury.

### For Women

Bed Warmer	Writing desk lamp
Cosmetic heater	Casserole
Comb and curling iron	Chafing dish
Curling iron	Coffee pot
Hair dryer	Coffee urn
Hair singe	Chocolate warmer
Heated comb	Immersion heater
Massage vibrator	Percolator
Smoothing glass	Samovar
Bed and boudoir lamp	Saute pan
House lamp	Teakettle
Battery candle	Toaster
Candelabra	Toaster stove
Floral decorations	Griddle
Illuminated mirror	Water cup
Illuminated table ornament	Water heater
Bungalow portable	Broiler
Cut glass portable	Cereal cooker
Indirect lighting portable	Combination cooker
Mission portable	Cook stove
Reed or wicker portable	Disk stove
Piano lamp	Egg cooker
Reading lamp	Fireless cooker
Table lamp	Flat iron

(List continued on page 49)



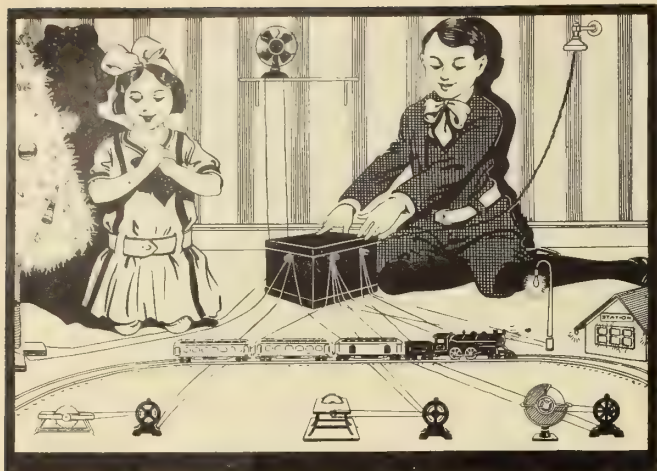


Fig. 1—Toy transformer operating train, grindstone, circular saw and other machinery.—Thordarson Electric Manufacturing Company, Chicago, Ill.



Fig. 5—1/30 h.p., 110 volt motor, consumes 35 watts.—Menominee Electric Manufacturing Co., Menominee, Mich.



Fig. 6—Christmas tree lamp outfit.—Import Sales Company, New York.

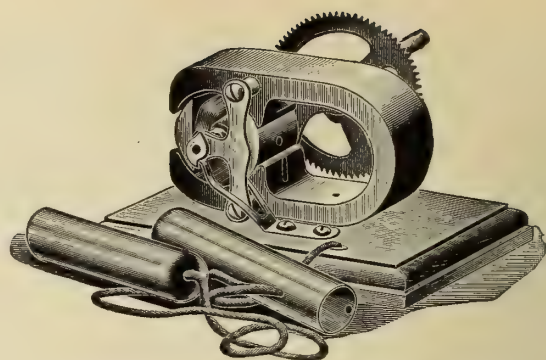


Fig. 2—Electric thriller magneto, hand-operated.—Knapp Electric & Novelty Company, New York.



Fig. 3—Rex motor, operates on one cell, size 3 by 3½ by 3½ inches.—Kendrick & Davis, Company, Lebanon, N.H.

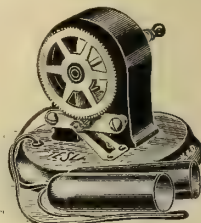


Fig. 4—Tesla magneto-electric machine, operated by crank.—Kendrick & Davis Company, Lebanon, N.H.

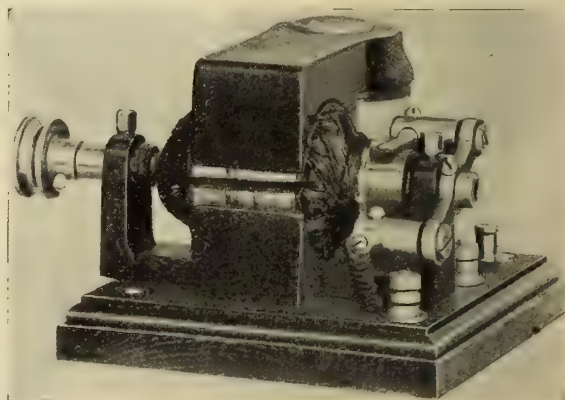


Fig. 7—Motor or generator, 16-18½ volts, height 4 inches.—Menominee Electric Manufacturing Company, Menominee, Mich.

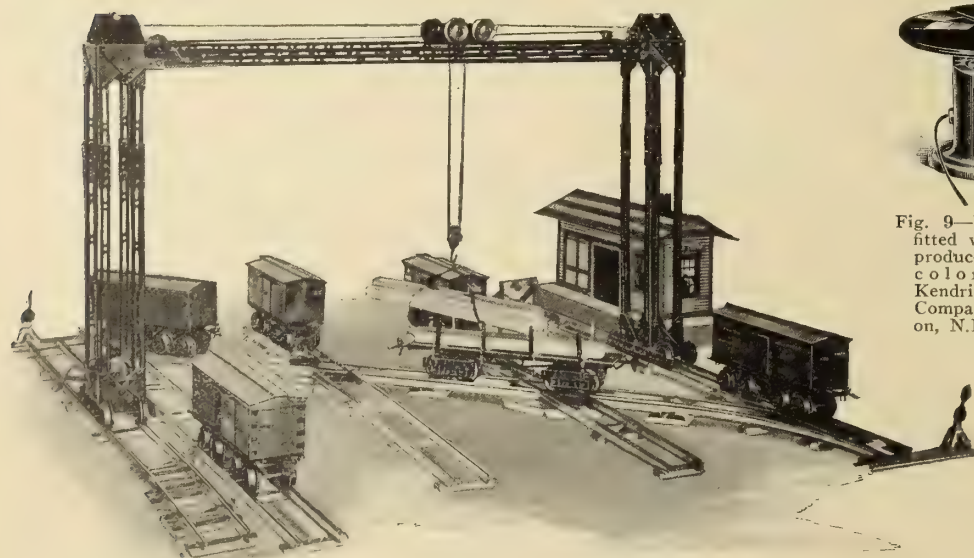


Fig. 8—Electrically-operated train yard with derrick for loading and unloading.—Ives Manufacturing Corporation, Bridgeport, Conn.

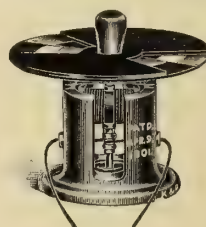


Fig. 9—Electric top, fitted with discs to produce beautiful color effects.—Kendrick & Davis Company, Lebanon, N.H.



Fig. 10—Safety first hand lamp, operated by standard dry battery, throws light on ground, burns 40-60 hours.—Federal Sign System (Electric), Chicago, Ill.



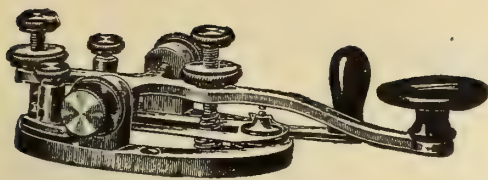


Fig. 11—Legless telegraph key for beginners.—Menominee Electric Manufacturing Company, Menominee, Mich.

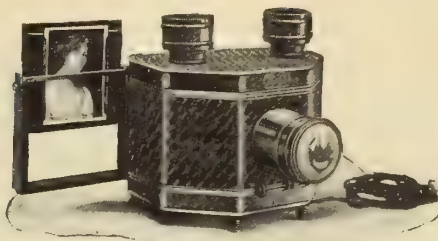


Fig. 12—Electric Radiopticon, shows post cards or larger pictures in natural colors.—H. C. White Company, North Bennington, Vt.

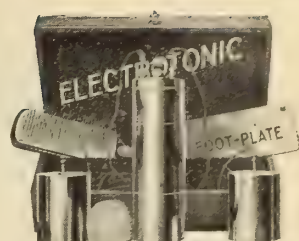


Fig. 13—Electrotonic outfit complete, weighs three pounds.—Stanley & Patterson, Inc., New York.

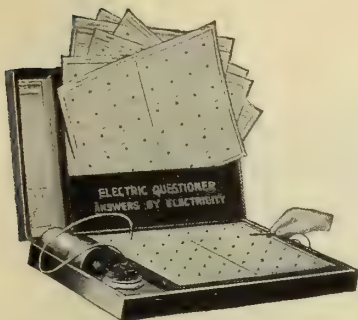


Fig. 14—Electric questioner, answers by electricity.—Knapp Electric & Novelty Company, New York.

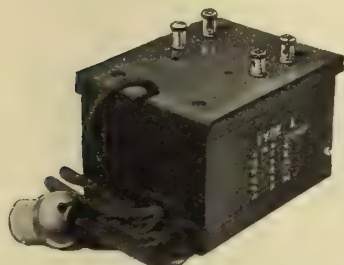


Fig. 16—Toy transformer, voltages 3-5-8-12-17-20 volts, capacity, 60 watts.—Lionel Manufacturing Company, New York.

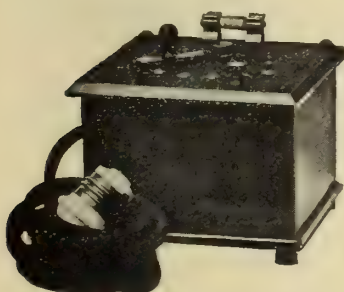


Fig. 18—Toy transformer, voltages 7-11-14-17-20-24, capacity 120 watts.—Dongan Electric Manufacturing Company, Detroit, Mich.

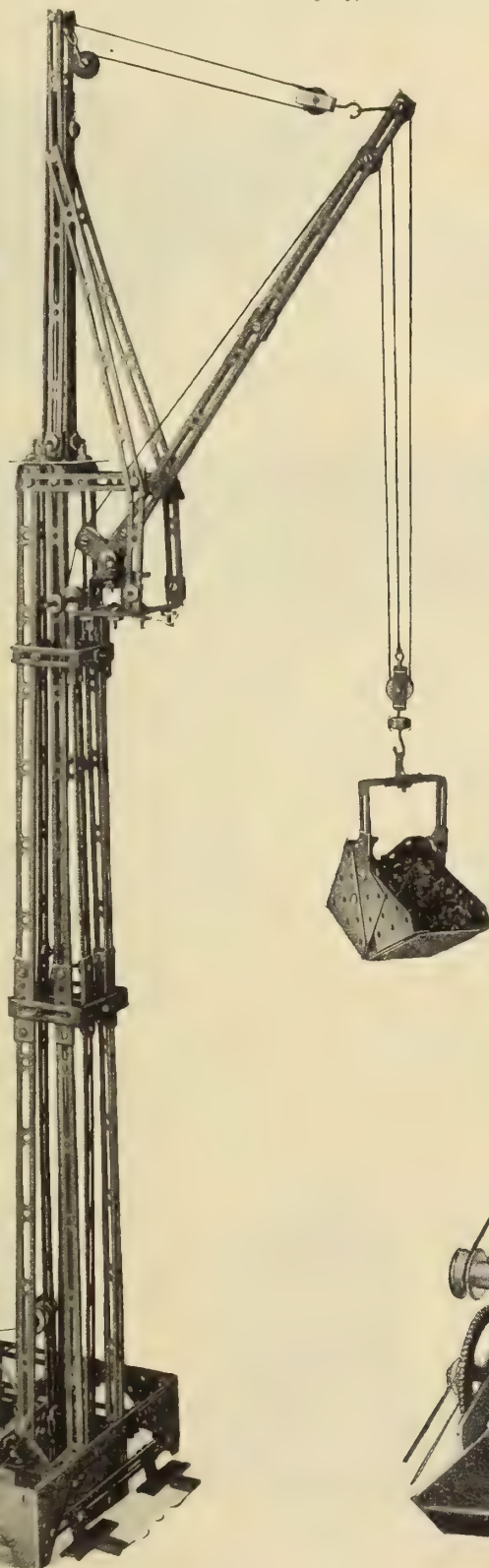


Fig. 20—Electric derrick, 31 inches high.—Ives Manufacturing Corporation, Bridgeport, Conn.



Fig. 15—Toy transformer, voltages 6-9-15, capacity 60 watt.—Dongan Electric Manufacturing Company, Detroit, Mich.

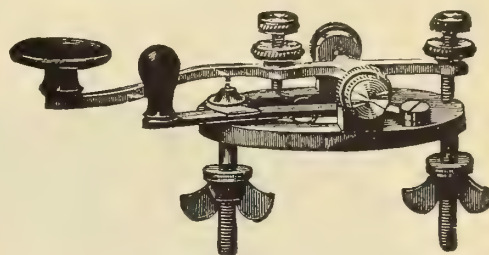


Fig. 17—Same as Fig. 11, but with legs.—Menominee Electric Manufacturing Company, Menominee, Mich.



Fig. 19—Magneto-electric machine, for electro-medical work.—Stanley & Patterson, Inc., New York.

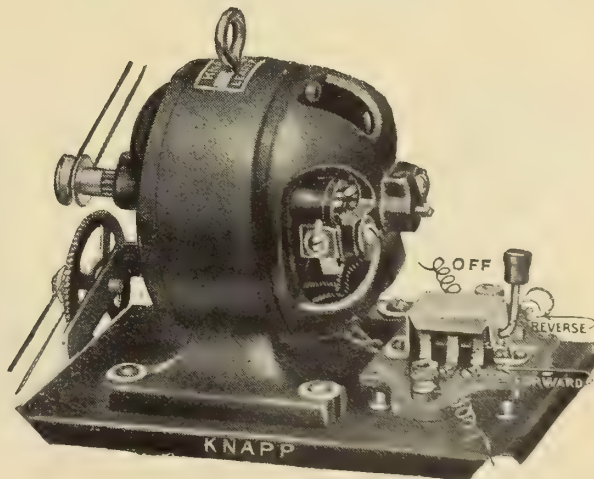


Fig. 21—Driving motor, equipped with starting and reversing switch.—Knapp Electric & Novelty Company, New York.



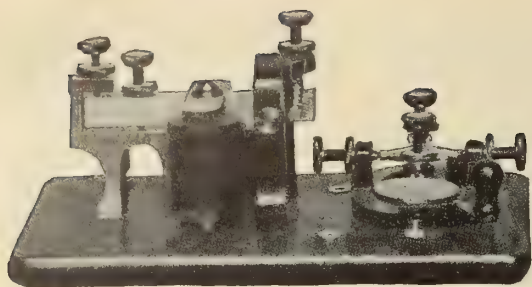


Fig. 22—Junior learner telegraph set.—Menominee Electric Manufacturing Company, Menominee, Mich.

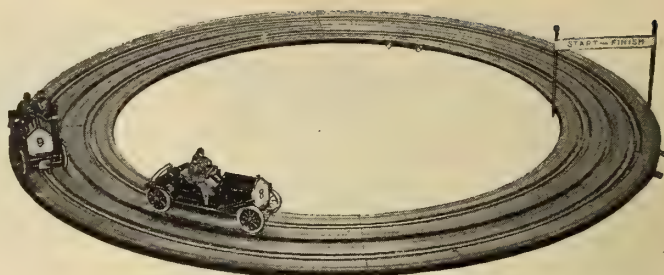


Fig. 23—Electric automobile race track, operates from toy transformer or by battery.—Lionel Manufacturing Company, New York.

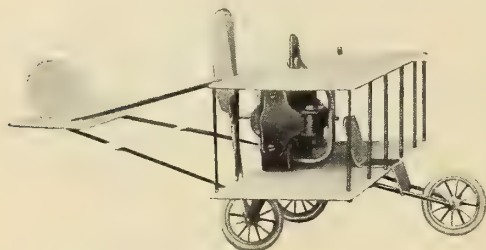


Fig. 24—Curtiss Biplane, planes 12 inches long, operates on 4-6 dry batteries or toy transformer and travels in a circle 3-25 feet in diameter.—A. E. Rittenhouse Company, Honeoye Falls, N.Y.

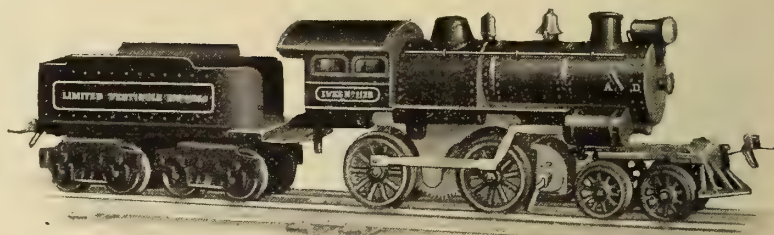


Fig. 25—Electric locomotive, 8 3/4 inches long, with reverse.—Ives Manufacturing Corporation, Bridgeport, Conn.

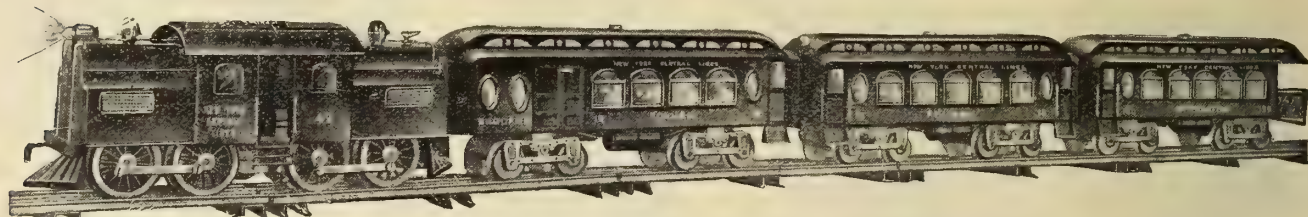


Fig. 26—Electric train 5 ft. 5 in. long, electric head-light and illuminated cars.—Lionel Manufacturing Company, New York.

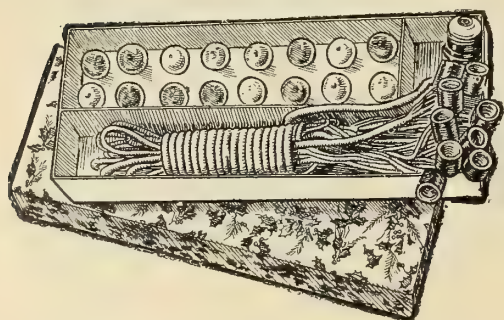


Fig. 27—Set of lamps for Christmas tree decoration.—Import Sales Company, New York.

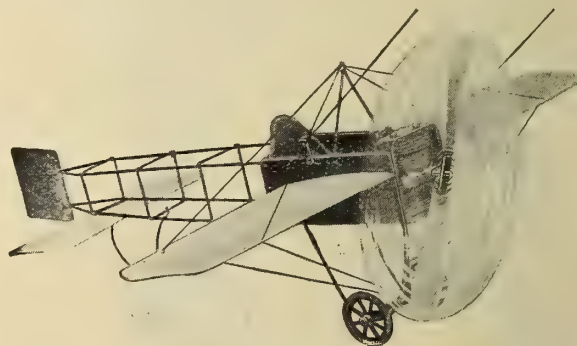


Fig. 28—Bleriot monoplane, spread of planes 22 inches, travels in circles 5-100 ft. in diameter at 12 miles an hour on 8 dry batteries.—A. E. Rittenhouse Company, Honeoye Falls, N.Y.

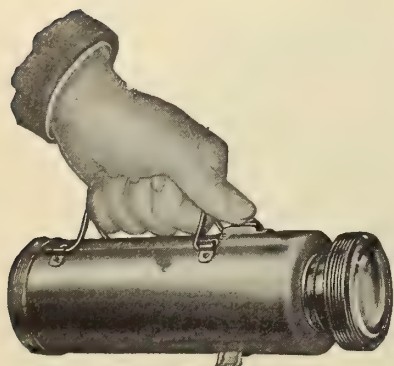


Fig. 29—Handy flash light, accommodates standard dry cell, operates for 50 hours.—Beers Sales Company, Bridgeport, Conn.

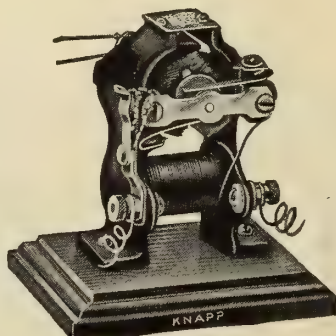


Fig. 30—Little Hustler motor, runs on dry cell, fitted with pulley for driving toys.—Knapp Electric & Novelty Company, New York.

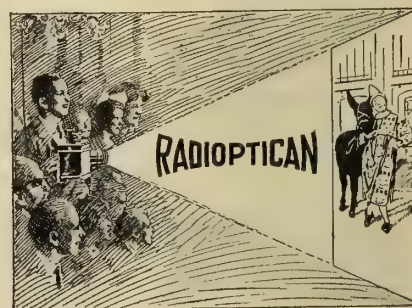


Fig. 31—Radioptican, a highly enjoyable and instructive form of entertainment.—H. C. White Company, North Bennington, Vt.



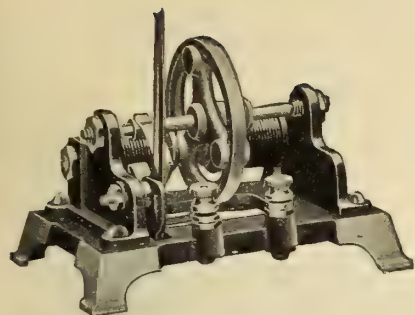


Fig. 32—A powerful little motor which operates on one dry cell, reversible—H. K. Electric Toy Company, Indianapolis, Indiana.

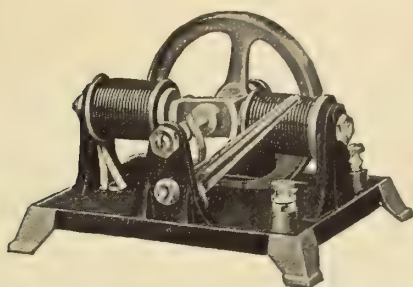


Fig. 33—2 pole type motor for operating toys, body of motor red, trimmed with gold, operates on one dry cell—H. K. Electric Toy Company, Indianapolis, Ind.



Fig. 34—Powerful toy transformer—Thordarson Electric Manufacturing Company, Chicago, Ill.



Fig. 35—110 volt 60 cycle transformer, delivers 10 and 12 volts—Ives Manufacturing Corporation, Bridgeport, Conn.



Fig. 36—Electric candle, batteries concealed within the candle. Tungsten lamp J. H. Bunnell & Co., New York.

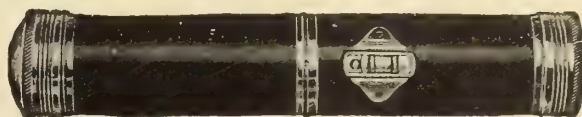


Fig. 37—Ever Ready flashlight—Northern Electric Company, Limited, Montreal.

Frying pan  
Grid  
Grill  
Hot closet  
Oven  
Plate warmer  
Domestic range  
Table range  
Table cooking set  
Waffle iron  
Battery lantern  
Bell ringing transformer  
Candelabra lamp  
Chimes and bells

Dish washer  
Home ironing machine  
Vacuum cleaner  
Washing machine  
Kitchen cabinet  
Ozonator  
Perfumer and disinfectant  
Radiator  
Sewing machine motor  
Traveling iron  
Traveling stove  
Utility motor  
Automobile (electric)  
Limousine telephone set

#### For Men

Battery lantern  
Bed foot warmer  
Bicycle lamp  
Hand lamp  
Cigar lighter  
Electric scarf pin  
Electric watch charm  
Flashlight cane  
Pistol flashlight  
Pocket testing meter  
Drink mixer  
Hair singe  
Illuminated mirror  
Shaving mug  
Shaving glass and lamps  
Silk hat iron  
Traveling iron  
Traveling stove

Vibrator  
Water cup  
Alarm clock  
Reminder clock  
Bed lamp  
Chair lamp  
Floor portable  
Table or reading lamp  
Automobile battery lamp or lantern  
Automobile foot warmer  
Automobile trouble lamp  
Chest of automobile lamps  
Glove, auto signal or electrically heated  
Electric horn  
Traveler's lamps, cord and plug

#### For Older People

Electric bath cabinet  
Foot warmer  
Heating pad  
Medical battery  
Medical coil  
Nurse signal  
Ozonator  
Perfumer and disinfectant  
Vaporizer  
Ozone blanket  
Radiator  
Sterilizer  
Vibrator  
Violet-ray apparatus  
Chocolate warmer

Egg cooker  
Immersion heater  
Milk bottle, or food warmer  
Toaster  
Toaster stove  
Water cup  
Water heater  
Battery candle  
Ceiling clock  
Electrically-lighted table clock  
Bed lamp  
Regulating lamp or socket  
Hearing device

#### Telephone Systems

The Ontario Railway and Municipal Board are distributing copies of "Telephone Systems," which includes the text of the Ontario Telephone Act and amendments to date; extracts from report of the Ontario Railway and Municipal Board for 1913; specifications for the construction of telephone systems; forms of petition and by-law for telephone systems established under part 2 of the Ontario Telephone Act, etc. The Board will be pleased to mail a copy of this pamphlet to any person sufficiently interested in telephone matters to make application.

The pamphlet tabulates a summary of the returns from 463 telephone companies, municipalities, and individual owners of telephone lines in Ontario up to December 31st, 1913.

#### Nairn Falls Power Co.

The Nairn Falls Power Company, Limited, 811 Rogers Building, Vancouver, is making application for a license for the storage of 100,000 acre feet of water out of the Soo River which flows westerly and drains into Green River about one half a mile south of the southern end of the Lillooet Land Recording District. The water will be used for power purposes.

#### Effective and Inexpensive

The James Corr Electric Company, of Omaha, have hit upon an effective form of retail advertising that costs comparatively little, keeps them in touch with the prospective purchaser all the time, and has been found to give good results. Each month this company issues some 6,000 blotters, the colors being varied from month to month so as to distinguish them, at an expense of about \$5 per thousand. This includes printing and delivery by carrier to all the principal business houses in the city. Unlike the average blotter, which would contain little more than the name and address of the firm distributing them, these blotters each month are covered with useful hints and suggestions on the wiring of your house or the use of electrical supplies of various sorts. Interspersed with these informing items are a number of more or less humorous paragraphs, which help



further to emphasize the name of the firm and to keep the blotter in the mind of the reader.

As indicating the type of information distributed each month in this way, we print below the blotter of September 15th, 1914, which Mr. Corr has been good enough to send us. We believe the idea is a very excellent one and may well be followed by many Canadian jobbers who at present may have difficulty in getting in touch with as many customers as they would like. Reaching a customer with a direct message which stays with him during the month at a cost of only half a cent is cheap advertising.

## THE BLOTTER

Vol. 1. OMAHA, SEPTEMBER 15, 1914 No. 9

Published 15th of Month at 205 So. 19th St. for the benefit of the James Corr Electric Company

Entered at Business Offices as First-class Blotting Matter

Subscription Rates, a Request. Call Doug. 4466

Circulation, All Over the Desk

**OUR MOTTO: RELIABLE WIRING**

See us for latest designs in Lighting Fixtures. Our prices are right.

Some matrimonial bonds are very good dividend payers.

The motor business has continued good this month with 1-25HP, 2-20HP, 1-10-HP and 2-5HP with several small ones. Even our little place makes the Jobbers envious of our motor sales.

Many a fine blacksmith has been spoiled because a fond mother imagined he had musical talent.

The Starr-Kingman Shoe Co. have a nice new window which is the finest display window west of Chicago. This window must be seen to be appreciated and would advise that you stop when down that way and look it over. Of course, the electric work was furnished by the James Corr Electric Co.

Two Irishmen coming to the United States were shipwrecked on the way. Mike swam safely to shore and immediately after turned and started to run back into the water.

Bystander — "Where are you going, Mike?"

Mike — "I've saved myself. Now I'm going back to save Pat."

We have a new charging plant for electric automobiles, which is bound to be a winner, as it does away with the expense and annoyance of the rectifier and is far more efficient and the cost is not as great. They have the advantage of being absolutely fool-proof and cannot get out of order. If you contemplate installing anything of this kind, we would advise that you see us. Call us at Douglas 4466,

and we will be very glad to demonstrate this plant.

And you can borrow trouble on darn poor Collateral.

How about your Dry Batteries? We handle the Columbia No. 6, which is absolutely guaranteed to be the best battery in the world, without exception. Stop and see us for your requirements.

Many a man has smashed his own thumb nail when he started out to "nail a lie."

By installing our Mazda Lamps in all rooms in one of the largest hotels, the proprietor has cut his bill almost two-thirds and the guests are much better satisfied with their light. Stop in and get a carton for trial. AH lamps absolutely guaranteed.

Ask us about the use of transformers on your bell systems—does away with batteries — insures satisfactory and lasting service.

We are placing Flash Lights at the very reasonable price of 75 cents for the entire outfit and the very best large styles on the market for \$1.25. At these prices, no one can afford to be without one for emergency use.

Two Irishmen, meeting one day, were discussing local news.

"Did you know Jim Skelly?" asked Pat.

"Faith," said Mike, "an' I do."

"Well," said Pat, "he has had his appendix taken away from him."

"Yez don't say so," said Mike. "Well, it serves him right. He should have had it put in his wife's name."

### D. C. Cable Testing Ammeter

The Metropolitan d.c. cable testing ammeter is so designed as to measure the current in a conductor without either disturbing or open-circuiting the same. This instrument is ready for immediate use by removing the "U" shaped iron strap, placing the conductor within the loop of same and re-installing the strap to the instrument terminals. It will then indicate the current flowing in the enclosed conductor when the key controlling the moving coil circuit is pressed. This instrument resembles in principle those of the D'Arsonval type excepting that the permanent magnet is replaced by the detachable iron loop and the moving coil circuit is energized by a small auxiliary battery. It will be readily seen that when the iron loop encloses a conductor carrying current, the flux in the magnetic circuit of the instrument will be proportional to the current flowing in the



conductor and as the moving coil is independently energized by a current of constant value the deflections of the pointer on the scale will be proportional to the current flowing in the conductor.

This instrument will be found to be extremely useful for such purposes as the measurement of current in direct current networks, loads on house or service wires, bus bars, etc., where it is found to be inconvenient or impossible to open the conductor for the series connection made necessary by the ordinary ammeter. This instrument occupies a place in direct current measurement which is identical with that of the portable split-core current transformer and ammeter as used in alternating current measurements. It will be found of special value in the supervision of networks where the distribution of load from feeding points and the balancing of the system have to be checked at frequent intervals. Measurements of this nature with ordinary instruments would, in many cases, be so expensive as to be prohibitive, and for this reason in the majority of cases, these measurements, while desirable, are not made, the distribution being a matter of guess-work. The Metropolitan d.c. cable testing ammeter makes it possible to take such measurements rapidly and at comparatively small expense. The instrument is compact, weighing only 4½ lbs. It is substantial, simple in design and may be handled and calibrated by the ordinary workman as this calibration simply consists of having a conductor of known value inserted in the loop and a few simple adjustments made. Should the instrument at any time become out of adjustment, this may be regulated by means of a small regulating resistance provided in the moving coil circuit whereby the current in the moving coil



may be adjusted until the instrument corresponds to the current to be measured.

#### An Interchangeable Sign

The Canadian Steel Products Company, Limited, Montreal, have just put on to the market an interchangeable sign entirely made in Canada. Fig. 1 shows the standard 25-letter space sign. For each sign there are 125 slides or glasses,

point is made, by the makers, of the adaptability of the sign, which can be easily adjusted. The company are also makers of "Cansteel" products, cutout and panel boxes, cabinets, steel shelving, racks, steel lockers, etc.

#### A New Sectionalizing Switch

A new automatic sectionalizing switch with a continuous capacity of 800 amperes and adjustable for overloads of 600

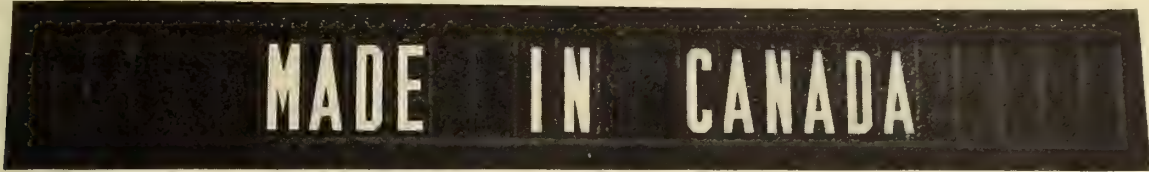


Fig. 1—Interchangeable sign of the Canadian Steel Products Co.

comprising the alphabet, numbers, characters, and blanks, the letters which are more frequently used, such as A and E, being duplicated, so that any advertisement or word desired can be formed. The advertisement can be changed at will, which is one of the great advantages claimed for this character of sign. The letters, 4 in. high, are left clear on the glass, and the black painted around the letters. The opaque glass is always left in the grooves, and consequently when the letter is slid over the opaque glass all that is seen is the white letter against the black background. The frame

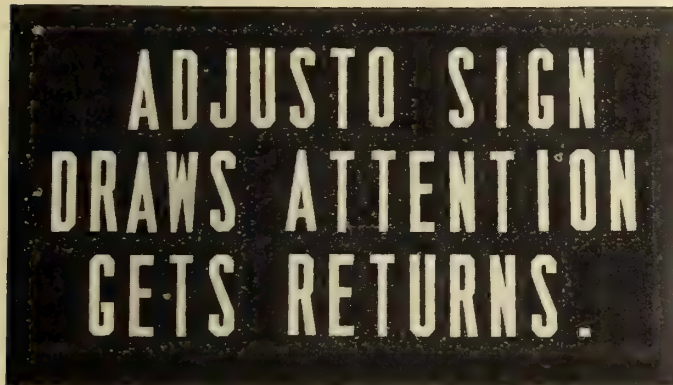


Fig. 2—Sign of different size and shape.

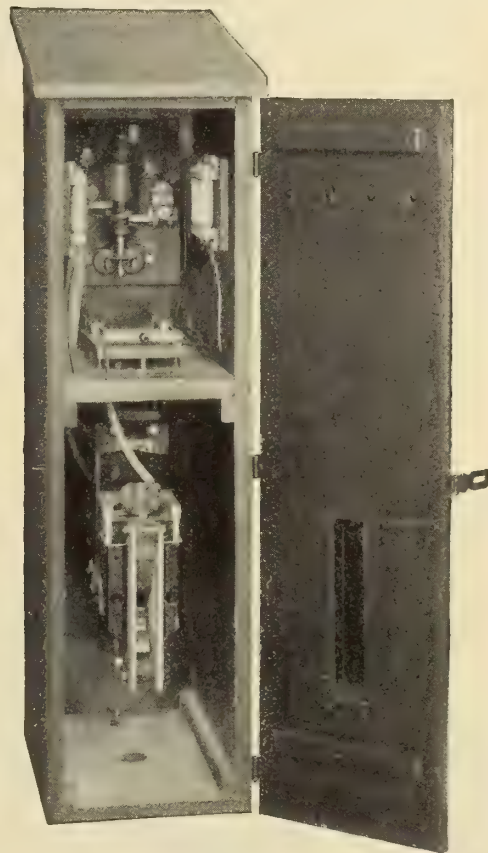
of the sign is of steel, electro-plated gun metal, giving it the highest of finishes and durability, not attained in any other kind of frame. The sign box is of galvanized iron painted on the inside with reflecting aluminium paint, and has tungsten lamps wired with motorless flasher. There are 10 feet of reinforced cord with attachment plug for its connection. It is claimed that this combination makes the most effective night sign ever designed for window or indoor advertising. The sign can be hung up by chains, and is so arranged that



Fig. 3—Small but effective sign.

the box can be left and only the frame removed to change its wording. This saves re-dressing a window, and enables another show card to be displayed without cost. The signs can be manufactured in any style, containing any number of grooves or number of lines. This gives the jobber or contractor the opportunity of complying with the requirements of any store, advertiser, or manufacturer. A strong

to 1200 amperes is offered by the Canadian General Electric Company. This switch will equalize the voltage on all sections of a trolley line, thus taking care of overload conditions with a consequent improvement in service. An overload trip and automatic reset feature greatly increases the efficiency of the device. The switch is mounted in a long, narrow box conforming to the trolley pole on which it is to be installed. With this switch, an overload or short cir-



Sectionalizing Switch.

cuit on the line throws out only the station breaker feeding the section affected, thus avoiding interruption of service on the other sections. When the trouble is remedied and the station breaker again thrown in, all the switches on the line automatically close, once more desectionalizing the system. It is equally applicable to trolley wire or third rail systems and will enable companies to improve their operating conditions without the large outlay for feeder copper generally necessary.



### The "Autosign"

"The Autosign" is an interchangeable electric sign for window and show case advertising, invented by Mr. Morton Wright, of Montreal, the sole Canadian selling rights for which are held by Roper, Clarke & Company, Limited, Montreal. In addition to the usual features of interchangeable signs, it is pointed out by the makers that it possesses two others which are of interest—it is brilliantly lighted, and is, by reason of being made in Canada, much cheaper than imported signs. The Autosign has a white plate glass mounted in a polished ebony frame. The white plate contains grooves

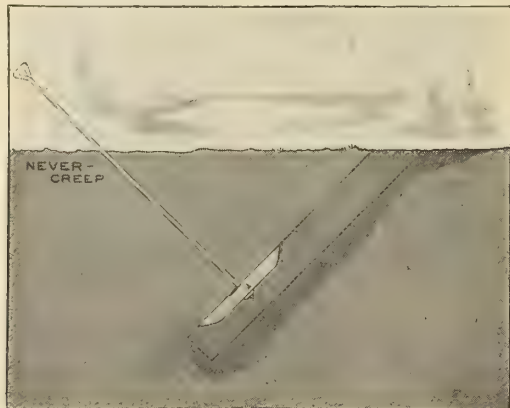


Interchangeable sign of Roper, Clarke & Co.

into which are fitted pure rubber letters; a plain glass is then drawn over the letters, giving the whole surface a finished appearance. One hundred letters and figures are supplied with the sign—other letters may be bought at 10c each if needed. Eight feet of cord, tungsten lamp and flasher are also supplied with the outfit. The letters are made of unbreakable rubber, and will last indefinitely. The cost of running the sign is as follows: ten hours per day at 7c per kilowatt, \$8.40 per year; ten hours per day at 5c per kilowatt, \$6.00 per year; at 3 cents per kw. \$3.60, and so on. The style shown in the illustration is 10 x 16 inches, but any size of sign can be supplied by the distributors.

### The New "Never Creep" Anchor

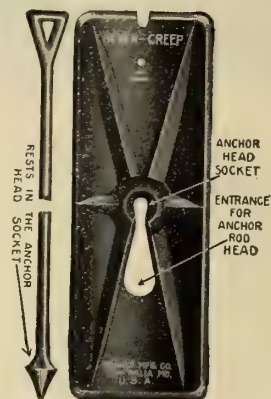
The Electric Service Supplies Company has entered into an exclusive selling proposition with the Chance Manufacturing Company to push the sale of the latter company's



Showing Never-Creep Anchor installed. Note the "pull" is against undisturbed earth.

"Never Creep" anchors. This anchor is the result of efforts to combine in one anchor all of the good features of the "dead-man" and the many other anchors on the market. In the accompanying illustrations, note that the design of this anchor makes possible the method of installation, i.e., the

fact that the "pull" is against undisturbed earth which does not allow the anchor to creep. The anchor itself consists of two separable parts—the anchor rod and anchor plate. The anchor rod is of from one-half to one inch steel, depending on size of anchor, and is so designed to be easily driven through the undisturbed earth. The anchor plate is curved and reinforced and is of cast iron. In size, the plates range from 3½ x 10 inches to 11 x 40 inches, depending on size of anchor required. All parts are treated to effectively withstand the action of rust. The anchors are installed by boring a hole (preferably with an auger) at as near a right angle to the line of strain as conditions will allow. The anchor rod



Never-Creep Anchor Rod and Plate.



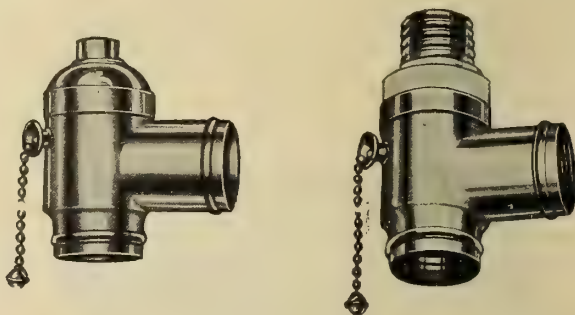
Tamping Bar with special end fitting for lowering plate into hole.

is then forced down through solid earth, by driving, stopping the head of the rod about the centre of the hole. After the anchor rod is installed, it is only necessary to lower the anchor plate into the hole, by means of a special tamping bar, engaging socket in plate with head of rod, then to pull up on rod and the anchor is ready for service.

### Twin Pull Sockets

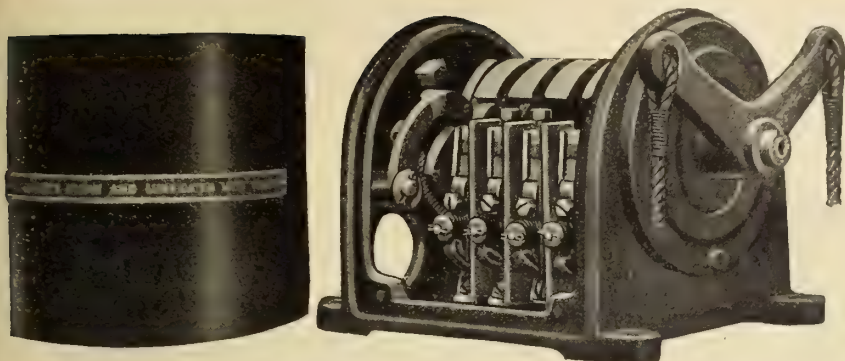
Pull sockets with outlets for two lamps are being made by the Bryant Electric Company, Bridgeport, Conn. An attachment plug, of course, may be substituted for one lamp or two attachment plugs may be used instead of two lamps.

This socket is made in two types. In one type both outlets are simultaneously put on or off by successive pulls of the chain. In the other type the straight outlet alone is affected when the chain is pulled, the lamp in the angle outlet being on all the time. The first type is useful where it is desir-



able to turn on and off two energy-consuming devices at the same time or where one outlet holds a lamp which serves as a pilot lamp for an appliance connected to the other outlet. The second type is useful when it is desired to have a lamp or other energy-consuming device equipped with its own switch connected to the angle outlet. A shade holder can be attached to either outlet and can be held in its normal position relative to the lamp.





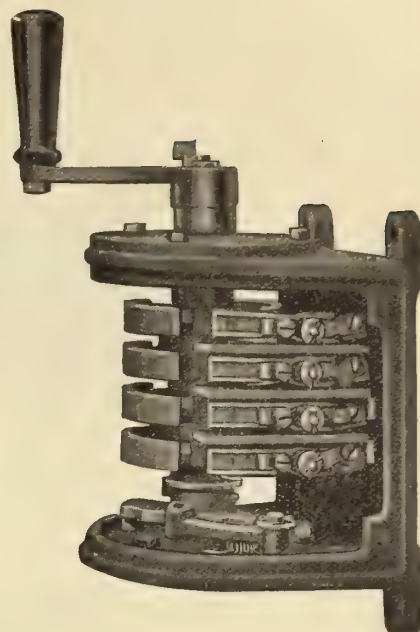
New enclosed reversing switch for squirrel cage motors arranged for rope operation.

#### Reversing Switches for Squirrel Cage Motors

The enclosed drum type reverse switches recently developed by the Cutler-Hammer Mfg. Co., Milwaukee, are designed for the reversing of small polyphase induction motors that may be thrown across the line in starting. As shown in the accompanying illustration provision is made for operating by means of a rotary handle or by means of ropes. In the latter case the drum switch may be installed out of reach, and in a position the reverse of that shown. This type of reverse switch is also adapted for use on small a.c. elevator equipment driven by high resistance rotor squirrel cage motors. The enclosing case protects the switch contacts from dust and dirt, and prevents accidental contact of the live parts by the operator or workman.

#### The Advertogram

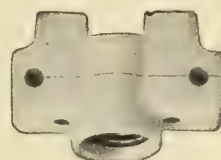
The "Advertogram" is a patented device for day and night use in show windows, the principal feature of which is that the reading matter can be changed in two minutes by sliding each letter separately into compartments. The letters are clear glass with black background, each letter being backed with a sheet of pure white opal that makes the "Advertogram" a wonderful day sign without being illuminated—a sign that can be read very plainly from the opposite side of the street. It is all metal, fifty inches long and seven inches high, illuminated with four 25-watt lamps that are flashed intermittently by a motorless flasher. The "Advertogram" has a black gun metal frame that adds tone, yet simplicity, to the highest class show window. Retail merchants, such as shoe stores, haberdashers, hatters, grocers, drug stores, etc., are the people to whom such a sign will appeal, because the merchant is then in a position to write his own show cards and the flashing of the sign



Cutler-Hammer reverse switch for induction motors (cover removed).

#### Decorative Outdoor Receptacle

The illustration herewith shows a new outdoor receptacle designed by the H. T. Paiste Company for use on the Garden Pier, Atlantic City. They have very plain yet graceful lines, and suit admirably the style of architecture. They were glazed a dark brown to harmonize with the tiling. The



binding screws are well protected, and are centre spaced so that both wires may be bared at the same place. The wires are carried one inch above the surface wired over. Drip holes are provided from the screw shell. The centre contacts are of phosphor bronze.

#### Automatic Pressure Switch

It is frequently desirable to be able to control automatically a motor pump for hydraulic or pneumatic water systems and vacuum systems and for this purpose the Can-



Interchangeable sign of Northern Electric Company, Limited.

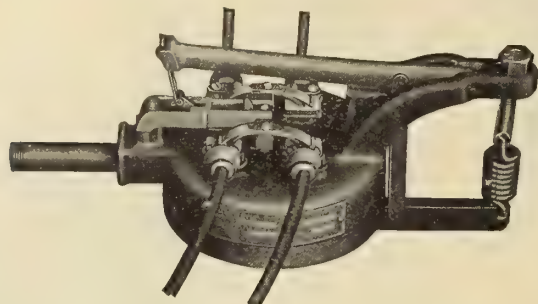
attracts the attention of the passers-by on both sides of the street. This "Advertogram" is not only adapted for use in the show window, but is being used extensively by departmental stores to indicate the various departments or special sales of the day. Moving picture theatres are also using the "Advertogram" to announce coming and daily attractions. The Northern Electric Company are the exclusive Canadian selling agency for the "Advertogram," and they report a big demand from all parts of the country.

Net earnings, for the first seven months of the year, of the Winnipeg Electric Railway Company, are \$1,030,124. It is a remarkable coincidence that the earnings for the same period a year ago were \$1,030,121.

adian General Electric Company offer the automatic pressure switch shown here. This switch is positive in operation and will open or close at the predetermined pressure without sticking or jamming of any kind. It will stand a pressure of 200 pounds without damage and bears underwriters' approval for 10 amperes at 250 volts or 20 amperes at 125 volts. For heavier service the switch is used in relay circuit which controls the motor starter. The construction of the switch is as follows: The bottom of a cup or pan shaped body casting is closed by a flexible phosphor-bronze diaphragm and on the top of this casting is mounted the switch mechanism. As the position of the diaphragm is varied by the internal pressure, its motion is communicated to the switch mechanism which in turn causes the switch



contacts to open and close when certain ranges of movement of the diaphragm are reached. The switch proper is of a double pole, quick break construction, its design following closely that of heavy current capacity circuit breakers. The current carrying parts are exceptionally heavy and take care



Pressure Switch.

of severe overloads. The connecting cables are all fastened directly to the stationary contacts eliminating the necessity of flexible connection to moveable parts of the switch.

#### Valuable Home Service

The employees of Siemens Brothers Dynamo Works have responded with great enthusiasm to the call to arms. A large number of men from their works and offices at Stafford, amounting in all to about 400, have already joined the forces, and, together with the reservists and volunteers from their head office, branch offices and other departments, the total amounts to over 520. The firm is arranging to keep the posts of all these men open, and ample provision is being made for all the dependents of those who have gone to serve.

#### Can't Beat Them

The stability of the modern tungsten lamp is well illustrated in an incident which occurred in Toronto a few days ago. The occupant of a second storey purchased a case of 250-watt nitrogen filled lamps of well known manufacture, and turned these over to an attendant, a careless one, as he proved afterwards, for attention. This attendant, believing he had removed all the lamps, bundled the empty cartons into the box and rolled the box out of the window to the courtyard below, where it lit on a stone and bounced and rolled several feet. Quite by accident, the proprietor later discovered that two of the cartons still contained lamps, and was much surprised on removing them, to find them absolutely uninjured.

C. H. Basters & Company, importers and dealers in electrical supplies, Toronto, state that last month's sales were the largest in the history of the company. Mr. Basters is at present in Holland on a purchasing trip.

#### Some Effects of War on Trade in England

It has been customary prior to the war with Germany for large quantities of electrical apparatus and appliances for use in Great Britain to be purchased, not only in the completed form, but in parts, from Germany. This has always been a cause of complaint by the manufacturers of such electrical apparatus and appliances in the United Kingdom. Shortly before the war several large contracts were made, so it was reported, with German factories for installation in Great Britain. As these appliances are required without delay, it is expected that the contracts for the same will now be given to British makers, the war having broken the other contracts. It is interesting to remember that two of the largest factories for making electric generating plants, and so forth, in the United Kingdom are branches of American companies.

It is calculated that the war will lead to the placing, even after it is ended, of a very large proportion of such contracts as previously went to Germany and Austria with manufacturers in Great Britain, thus resulting in a permanent business for the British makers.—(Daily Consular and Trade Reports).

The Dominion Government Building, formerly supplied with light and power by the Winnipeg Electric Railway Company, is now being served by the City Light & Power Department.

#### Trade Publications

**Turbo-alternators**—Circular No. 506 issued by the Railway and Lighting Department of the Canadian Westinghouse Company, describing Westinghouse turbo-alternators.

**Steam Engines**—Bulletin 128, issued by the Canadian Allis-Chalmers, Limited, describing Chandler-Taylor steam engines built for direct connection to electric generators.

**A Study in Contrasts**—folder issued by the Ohio Brass Company, Limited, illustrating and briefly describing several examples of evolution in electric operations owing to the use of O. B. material.

**Dim-a-lite**—Catalogue issued by the Wirt Company, describing and illustrating their complete line of Dim-a-lites and their method of operation together with a brief description of their mechanical construction.

**"Service"**—a very attractive booklet issued by the Robbins & Myers Company, Springfield, Ohio, describing in some detail the methods adopted by this company and the care taken in the manufacture of small motors for motor-driven machines of various sorts.

**Electric Heating**—a booklet issued by A. Schonfield, 21 Hope Street, Glasgow, describing the Grundy system of automatic temperature control and the Hestia electric stoves. The booklet contains much new and interesting information about the latest and most scientific methods of heating and ventilating by electricity.

**Westinghouse Publications**—The Westinghouse Electric and Manufacturing Company are distributing a number of interesting publications having special reference to electric railway work. These include special publication No. 1552, which outlines the progress made by the Westinghouse organization in the electric railway field during the past year. The October number of the Westinghouse Railway Data Exchange also contains interesting information along the same lines. Circular No. 1546 is a collection of illustrations, with brief notes, showing some of the advantages of multiple-unit trains in city, suburban and interurban service. Publication No. 1549 contains a number of interesting and attractive illustrations, showing operating conditions in many large traffic centres. Circular No. 1550 describes Westinghouse 1500 volt direct current sub-station equipment.

**C. G. E. Publications**—Bulletin 48,700, describing and illustrating Sprague electric monorail trains. Data book, describing new fixtures and fittings for multiple mazda lamps, issued by the Holophane Works of the General Electric Company. Catalogue No. 311, describing the counter-line of Holophane-D'Olier metal reflectors. Bulletin F, describing Wheeler multiple mazda fixtures for type C gas filled lamps. Booklet describing the type X Exide battery, for automobile starting and lighting service. Catalogue H, describing Hart & Hegeman 600-volt switches. Booklet No. 906, describing electric hoists for the efficient handling of all loads. Bulletin No. 43,320, describing type W flame arc lamps for series and multiple circuits. Publication 507, describing small capacity, standard unit switchboard, d.c. up to 575 volts. Publication 508, describing type R domestic electrical ranges.



# Current News and Notes

## Burford, Ont.

By-law was passed October 9th, authorizing expenditure of \$5,000 on a hydro-electric distributing system.

## Calgary, Alta.

The Alberta Government is being petitioned to extend their telephone line to the Dingman Camp, where it is suggested that a central exchange be installed with telephone lines radiating to the various oil drilling camps.

## Canso, N.S.

The Corporation electric lighting plant was put into operation this month. The plant consists of one 95 h.p. single cylinder gas engine with producer and accessories; one 62 kv.a., 60 cycle, 2300 volt, 1200 r.p.m. generator with exciter and panel, and one 8 kw., 4 ampere c.c. transformer. The streets are wired for 80, 60 c.p. series 4 ampere lamps. The entire plant was furnished and installed by the Canadian Allis-Chalmers Company.

## Chatham, Ont.

A by-law providing for an expenditure of \$90,000 for the installation of a sub-station and distributing plant in Chatham was carried by a majority of 938 out of a total of 1268 votes cast.

## Cornwall, Ont.

The ratepayers on October 14th carried a by-law extending the franchise of the Cornwall Street Railway, Light and Power Company for a period of twenty years.

## Danville, Que.

Extensive improvements are being made in the boiler house of the Danville Electric Light Plant.

## Elora, Ont.

Hydro-electric power was turned on in this town on October 22nd. Elora was formerly supplied with light and power by the Fergus Electric Light Company.

## Fort William, Ont.

The new belt line was opened for traffic on Tuesday, October 13th. The event was celebrated by giving free rides throughout the whole day to any citizens who cared to patronize the line.

## Galt, Ont.

The Water Commission are considering the installation of a gasoline-engine-operated auxiliary pump for emergency use.

## Goderich, Ont.

The Goderich Town Council will ask the Hydro-electric Power Commission of Ontario to have their engineers report on the completion of the Ontario West Shore Railway and its operation as a part of the Hydro-Radial System.

## Hamilton, Ont.

Tenders have been received by the Public Utilities Commission of Hamilton for the erection of a sub-station on the town hall site.

The Hamilton Board of Control will make application to the Hydro-electric Power Commission of Ontario for a report on the cost and probable receipts of the Hydro-Radial line from Georgian Bay to Guelph to Hamilton. The scheme has met with considerable favor in the district to be served by this prospective line.

## London, Ont.

Following the favorable Hydro-Radial vote in central Ontario, interested parties are agitating for the submission

It is understood to be the hope of the London & Port Stanley Railway Commission to have the electric equipment installed and the road electrically operated by May 1st, 1915. of a by-law in January authorizing the construction of a line connecting the Stratford City line and the London and Port Stanley system. An increased activity is noticeable in other towns of southwestern Ontario as well.

## Medicine Hat, Alta.

The Hudson Electric Company are busy installing a complete electric lighting system and some power work for the Maple Leaf Milling Company. This is a six-storey building and will require about 300 lamps. All work is run in conduit.

## Montreal, Que.

Directors of the Montreal Light, Heat and Power Company have declared their regular quarterly dividend of  $2\frac{1}{2}$  per cent., payable November 16th to the shareholders of record October 31st. The earnings of this company for the first four months of their fiscal year showed a gain of some 8 per cent. over the corresponding period a year ago.

It is now said that Sir Rodolphe Forget is the real purchaser of the plant of the Eastern Canada Power & Pulp Company, the transfer of which was recently made for the sum of \$200,000.

Aleidas Galipeault and Dominique Boisvert have registered as electricians.

Although a fair amount of work on the Cedars Rapids Manufacturing and Power Company's plant remains to be done, it is certain that the company will be in a position to supply current at the beginning of the year. The contractors, Fraser, Brace and Company, have completed the power house and the canal, and the heavy machinery has been installed. Work is being continued on the two transmission lines, one to Montreal and the other to Massena, N.Y., and indications point to the former being completed in two weeks' time.

The Cedars Rapids Manufacturing and Power Company have issued their fourth progress-report, dealing with the construction work on their generating plant to date.

Roper, Clarke and Company, Limited, Montreal, representing the Premier Accumulator Company, Limited, Northampton, Eng., have completed the installation of a 57 cell battery in connection with the automatic signalling system just put into use by the Grand Trunk Railway on the Victoria Jubilee Bridge, Montreal, and its approaches. This system was fully described by Mr. R. F. Morkill in our issue of September 15.

Mr. G. M. Gest has been admitted to the membership of the Montreal Board of Trade.

## Moncton, N.B.

The Moncton Tramways, Electricity and Gas Company put into operation, this month, their new motor-generator set. It consists of one 200 kw., 550 volt, d.c. railway generator direct coupled to a 3-phase, 60 cycle, 1100 volt motor, 900 r.p.m. The outfit was supplied by the Canadian General Electric Company.

## Orillia, Ont.

Superintendent Greenwood has recommended the immediate expenditure of the sum of \$700 to improve the distribution and lighting system.



**Peterborough, Ont.**

The Utilities Commission has accepted the offer of the Hydro-electric Power Commission of Ontario to sell second-hand C. G. E. and Westinghouse meters at the price of \$4.10 each. These are 60-cycle meters taken from towns in the Hydro area that have been changed over from 60 to 25 cycles.

**Port Arthur, Ont.**

The pump house of the municipality of the city of Port Arthur, formerly located at Current River, is being removed to the northern city limits, where a new intake is being installed. The city is also erecting at this point a high-tension sub-station 25,000/2,200 volts for the operation of this and other plants likely to locate in the neighborhood. They have also built during the summer a low tension, 2,200 volt line connecting the Current River sub-station with the new pumping plant, and a 25,000 volt line connecting the pumping plant sub-station with the main hydro-electric sub-station. The approximate cost of the two plants and the high and low tension lines was \$44,600.

**Regina, Sask.**

The operation returns of the Regina Municipal Railway System for the week ending October 3rd were as follows. Revenue, \$3,293.95; passengers carried, 77,507; the corresponding figures for the week ending October 10th were \$3,471.30 and 80,829, and for the week ending October 17th, \$2,880.05 and 76,213.

A temporary amalgamation of the outside and inside electrical workers has been brought about. The amalgamation will be effective during the winter months and is the result of the scarcity of work during these months. The new union will consist of between 70 and 80 members.

**Shannon, Que.**

The Springfield & Wickham Rural Telephone Company, Limited, has been incorporated with head office in Shannon, Queen's County, N.B.

**St. Catharines, Ont.**

The cause of a recent fatality in St. Catharines, whereby Mr. A. J. Leach lost his life by touching an electric wire in his home, is said to have been due to lack of inspection and improper electric wiring. Apparently it is a repetition of the old trouble resulting so often where transformers are either improperly grounded or not grounded at all.

The Lincoln Electric Light and Power Company have asked that the St. Catharines Hydro-electric Commission be restrained from interfering with the company's poles and lines.

**St. John, N.B.**

The Canada Nail and Wire Company have commenced a plant here for the manufacture of horse shoe nails. They are installing a lighting system using multiple C. G. E. magnetite arc lamps and, when completed, will have one of the best lighted plants in Canada.

The Atlantic Sugar Refinery put their electrical plant in service last month. It consists of two 300 kw., 250 volt, 3 wire, direct-current generators and one 200 kw., all direct connected to McIntosh & Seymour Corliss horizontal engines. The electrical equipment was installed by the Canadian General Electric Company.

**Stratford, Ont.**

The local Light and Heat Commission have voted \$3,500 to the Canadian Patriotic Fund, and \$200 to the Belgian Relief Fund.

The Light & Heat Commission have decided to provide

light free of charge to the families of the soldiers, whether reservists or volunteers, who have gone to the war.

**St. Thomas, Ont.**

Between January 1st and September 30th of the present year, 330 new electric customers have been connected up, bringing the present total to 1,715.

**Toronto, Ont.**

The public school yards are being illuminated with four large nitrogen tungstens each.

Contracts have been awarded for the supply of school telephones in Earls Court, Dufferin and Clinton Schools to Mr. Geo. J. Beattie, 72 Victoria Street, and in Hester How School to Lintz Porter Company.

Work is progressing on the Queen Street East extension of the Toronto Railway System, which will soon reach to the city limits. The famous stub line is being torn out and replaced by approximately a mile of double track, reaching from McLean to Blantyre Avenue at the city limits.

The Board of Control recently passed a resolution instructing Corporation Counsel Geary to apply to the Dominion Railway Board for an order compelling all railways entering the city to electrify their system to a point not less than two miles beyond the city limits.

Mayor Hocken is reported to have stated that he expects the new reduced rates will go into effect in Toronto about New Year's time.

The Canadian Laco-Phillips Company, Limited, has been licensed to carry on business within the province of British Columbia.

The city's request to the Ontario Railway Board to force the Toronto Railway Company to place 150 extra cars in service, was met by the company with statistics showing that the receipts were considerably less at the present time than at the corresponding period a year ago, and that, on account of the financial conditions, it is extremely difficult to obtain ready money with which to make extensions. The board appeared to consider the objections of the company as reasonable.

On October 19th thirteen towns and townships voted on the question of guaranteeing bonds sufficient to cover their share of expenditure on the hydro radial scheme which the Ontario Hydro-electric Power Commission of Ontario has outlined for the district north of Toronto. In eleven out of the thirteen districts, the vote was favorable to the construction of the radial lines. Newmarket town defeated the by-law by a vote of 337-275, and Uxbridge township also gave an adverse vote of 176-141. The towns of Whitby, Uxbridge, Markham, Stouffville and Port Perry all gave good majorities, the latter vote being 153 for to two against. In the six townships of Pickering, Whitchurch, Markham, Scarboro, Reach and Whitby, the majorities were also sufficiently decisive to justify the commission in proceeding with the work. As the two points where the adverse vote was recorded are at the extreme end of the proposed line, it is not likely that the general scheme will be weakened in any way. It now rests with the towns and municipalities to say whether the commission shall go ahead with the work. The vote of course was taken subject to the Dominion Government granting a mileage subsidy, and it is unlikely that any definite steps will be taken in construction work before the Dominion Government gives a further assurance of this subsidy.

The Ontario Railway and Municipal Board have handed down a decision that the Toronto Suburban Railway Com-



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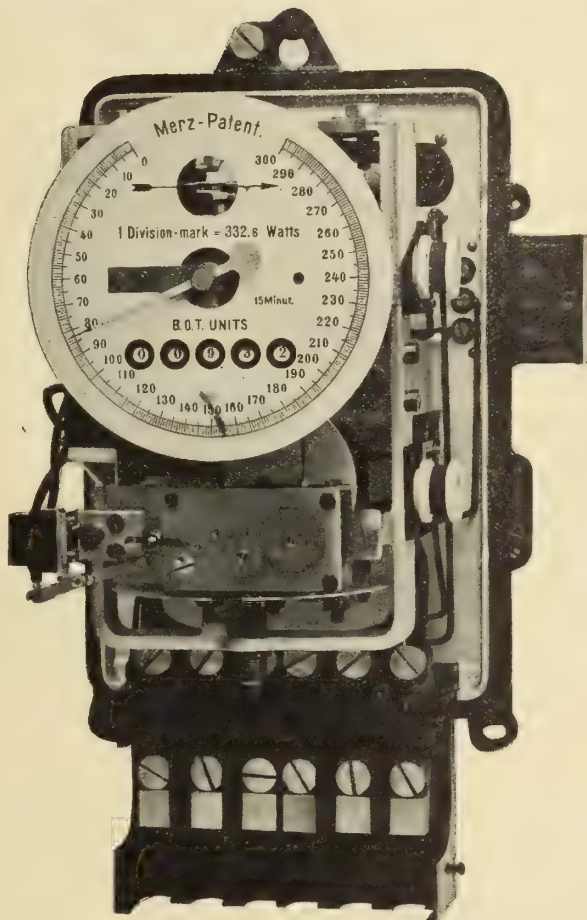
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## What the Meter Does

1. Gives the kilowatt hours.
2. The highest load demanded in watts on a time average of say 15, 30 or 60 minutes.

The accurate measurement of these two quantities enables a true load factor system of charging to be adopted.



## What can be Done With the Meter

1. Charge an annual sum per K. W. or Horse power year to cover capital and standing costs.
2. Charge a low straight rate per K. W. hour based on running costs and profit required.

## These Meters are Approved by the Board of Inland Revenue

Siemens combined integrating and maximum demand meters.

We have in STOCK three phase meters suitable for 110 volts and 550 volts for 25 and 60 cycle circuits, also meters for use with instrument transformers for large capacities.

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pany must build a single track on Annette Street from Keele to James Streets.

The Toronto Railway Company objected before the Ontario Railway and Municipal Board to the cross-town line recommended by the Board's engineer. The company backed their objection by the personal evidence of the manager of the Cleveland Electric Railway System, who stated that such a line did not prove a success in Cleveland and that the old system has been resorted to.

Additions are at present under way to the electric pumping system in Toronto, which will bring the total up to approximately 175,000,000 gallons per day.

#### Uxbridge, Ont.

At a mass meeting in the town of Uxbridge on the evening of Thursday, October 22nd, it was urged that the municipal councils of Uxbridge Township and of Newmarket town, re-submit their Hydro-Railway by-law. Failing this, it was stated that Uxbridge would apply to the Hydro-electric Power Commission of Ontario for connection with the eastern section of the radial by way of Brooklin, in which case only about three miles of the road would pass through Uxbridge township.

#### Walkerton, Ont.

The Bruce Municipal Telephone system will be extended, the necessary permission having been obtained from the Ontario Railway and Municipal Board.

#### Welland, Ont.

The Welland Sign Company have just finished the erection of an attractive electric sign for the McMurray Electric Company.

#### Wallaceburg, Ont.

The town council have decided to equip a number of streets with a proper lighting system.

It is stated that the Wallaceburg Gas Company have raised their rates to commercial customers to 12 cents per

kw.h. and the rate to householders to 11 cents. The day service is also to be discontinued.

#### Walkerville, Ont.

The electors recently carried a by-law authorizing the purchase of the street lighting system for \$26,000, and the council has decided to extend the distribution lines along a number of streets not at present supplied.

#### Westville, N.B.

The intercolonial Coal Mining Company are installing an electrical pumping equipment in their Westville slope. The outfit consists of one 3 phase, 60 cycle, 300 kv.a., 450 r.p.m., 2200 volt generator, direct connected to a vertical engine with direct connected exciter; also one 175 h.p., 550 volt motor driving a high head pump. The electrical equipment is being furnished by the Canadian General Electric Company and the engine is being supplied by the Belliss-Morcom Company.

#### Williamsburg, Ont.

A by-law authorizing the expenditure of some \$3,000 on an electric distributing system was carried without a dissenting vote.

#### Wolfville, N.S.

The Acadia Electric Light Company are installing a small auxiliary equipment to take care of light loads. It consists of one 2-cylinder, 2-cycle, vertical, semi-Diesel, oil engine, 50 h.p., of Swedish manufacture, along with one A. T. B., 60-cycle, 37½ kv.a., 2,200 volt, 1,200 r.p.m. generator with exciter and panel. This town has only had a 1 a.m. service, but will now enjoy an all-night service.

#### Woodbridge, Ont.

Hydro-electric power was turned on at this point on Monday, October 12th. The Toronto Suburban Railway Company also commenced the operation of their cars into Woodbridge at that date, the celebration also of the widely renowned Woodbridge Fall Fair.

## "Leather Leggin's"

By Berton Braley

"Whin you want to build a railroad through the jungle or the veldt

Where there's niver annybody bin before,

Why, you call on Leather Leggin's an' he hitches up his belt  
An' takes it as his ordinary chore

To go slashin' through the forests where the monkeys chatter shrill

An' the lazy snakes are hiss'n' down below,  
Or to drag a chain an' transit over gulch an' grassy hill,  
As he marks the route the right av way will go!

"He's a nervy, wiry divil with his notebook an' his livil,  
An' he doesn't seem to know the name av fear;  
He's a sort av scout av progress, on the pay roll as a Civil—  
Though he ain't so awful civil, if you say it on the livil—  
On the pay roll as a Civil Engineer!

"Whin you need to dam a river or to turn it upside down,  
Or to tunnel underneath it in the mud,  
Or to bore an' blast a subway through the innards av a town,  
Or to blow aside a mountain with a thud;  
Whin you want to bridge a canon where there ain't no place to cling  
An' the cliffs is steep an' smoother than a wall,

Why, you call on Leather Leggin's and he does that little thing,

An' then comes round an' he asks you, "Is that all?"

"Oh, he always has a fire in his old an' blackened brier  
An' he tackles anny job that may appear,  
An' he does it on the livil, this here divil of a Civil—  
Though he ain't so very civil, if you put it on the livil—  
This here divil av a Civil Engineer!

"Now the bankers down in Wall Street gits the profits whin it's done

While us heavy-futted diggers gits the can,  
But we lifts our hats respectful to the engineer, my son,  
For that feller, Leather Leggin's, is a man!  
Yes, he takes a heap av chances an' he works like Billy Hell,  
An' his job is neither peaceable nor tame,  
But you bet he knows his business an' he does it mighty well  
An' I want to give him credit for the same!

"He is plucky—on the livil—and you'll niver hear him snivel  
Though fate does her best to put him in the clear.  
He's the grit that niver flinches—on the pay roll as a Civil—  
For he's sometimes pretty civil an' he's always on the livil—  
On the pay roll as a Civil Engineer!"



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# Condensed Department

## Meter and Instrument Man

Meter and instrument man desires position with power company, experienced in repair and list work on switchboard instruments and service meters or as switchboard operator. Apply Box No. 90, Electrical News, Toronto. 22

## Electrical Engineer

Technical graduate, 13 years Canadian experience, engineering and contracting, associate A. I. E. E., desires executive, engineering or commercial position, energetic and responsible. Apply Box 92, Electrical News, Toronto. 21

## Sales Engineers Wanted

A large firm specializing in the manufacture of motors of all classes desires to secure sales engineers in various parts of Canada. Firms who can carry a stock of motors are preferred. Write stating the territory that you can cover. Box 96, Electrical News, Toronto. 21-24

## Agents Wanted

Measuring instruments and circuit breakers—agents wanted in leading towns to represent firm starting to manufacture in England for Canadian market. Remuneration on commission basis. Reply, stating quantity of anticipated business, to Box No. 84, Electrical News, Toronto. 21

## Agents Wanted

Large firm making a complete line of electric centrifugal pumps; automatic electric compression water systems; electrically driven multi-stage turbine pumps; electrically driven double acting pumps and a number of other lines, want sales agents for various parts of Canada. Write stating what territory you can handle. Apply Box 94, Electrical News, Toronto. 21-23

## Engineer

Wanted: capable engineer to take charge of large steam generating station, must hold first-class certificate and have thorough experience of steam-turbo generators. Apply in writing, giving full particulars to R. H. B., P. O. Box 1710, Montreal. 21

## Electric Generator

Wanted—A good second-hand generator capable of supplying 250 to 300 lights. Must be in first class condition. Quotations also received on new generator of same capacity. Clarke Bros., Bear River, N.S. 21-22

## Disposal of Patent

The proprietors of Letters Patent No. 143153 relating to "Improvements in Rails, especially Tram-Rails, for preventing the formation of so-called ripples," desire to dispose of the Patent or to grant License to interested parties at reasonable terms with a view to the adequate working of the Patent in Canada.

Inquiries to be addressed to the actual proprietors, Mr. Erland Zell, Gothenburg, Sweden. 21

## Agents Wanted

Large firm making low voltage transformers and electrical measuring instruments wants sales agents for Canada. These transformers are for sign lighting, bell ringing, and toy requirements. The electrical measuring instruments include a complete line of switchboard and portable Ammeters and Voltmeters. All agents to work on a commission basis. Write stating what territory you can handle. Box 93, Electrical News, Toronto. 21-23

## Sales Agents Wanted

Large firm making electric centrifugal pumps, automatic electric compression water systems, electrically driven multiple storage turbine pumps, and electrically driven double acting pumps, wants sales agents in various parts of Canada. Representatives will be backed up with a liberal advertising campaign. Apply Box 86, Electrical News, Toronto. 21-22

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Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by COPPER-PLATING and zinc coating.

Clean threads and smooth enamelled interior allows rapid fishing.

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*There is only one object to observe.*

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Send for catalog giving full *description of this unique instrument* and also our full line of A. C. and D. C. instruments for Switchboard, Portable and Laboratory Work.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

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Mr. F. E. Gilbert, 303-4 Hale Bldg., 1326 Chestnut St., Philadelphia, Pa.  
Mr. Geo. H. Moseman, 176 Federal St., Boston, Mass.

Mr. Milton Mill, 915 Olive St., St. Louis, Mo.  
B. K. Sweeney Electrical Co., 2910 Huron St., Denver, Colo.  
Mr. Frank E. Smith, 682 Mission St., San Francisco, Cal.  
Mr. S. C. Dinsmore, 1933 Dime Bank Bldg., Detroit, Mich.  
Walter P. Ambos Company, 1729

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A. H. Winter Joyner, Ltd., No. 76 Bay St., Toronto, Canada.  
Weston Instrument Co., Ltd., Geneststrasse 5, Schoneberg, Berlin, Germany.  
Mr. D. R. Petest, 415 Fourth Natl. Bank Bldg., Atlanta, Ga.  
Mr. Edwin Wortham, Suite 28

Allison Building, 8th St. and Main St., Richmond, Va.  
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Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and double steel tape armored cable for a working pressure of 660 volts. This cable is for laying direct in the ground without any protection whatever and is similar to that supplied to the cities of Saskatoon, Prince Albert, etc., etc.

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*They're different*



We make an exclusive line of Fixtures for House, Bank, Church and Office Lighting.

*Our Designs are Original.*

We shall be pleased to submit special designs on application.

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as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of



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**ERECO  
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This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

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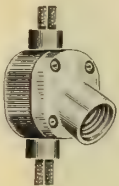
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# "Unilets"

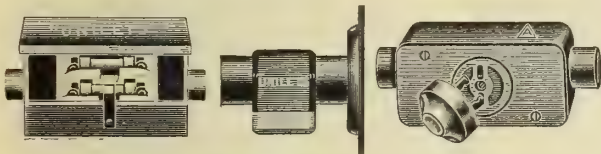
"A fitting for every fit. The most adaptable and flexible units on the market."



"UNILETS," being drawn from steel, are very much lighter than cast-iron fittings for the same size conduit, yet possess greater mechanical strength, and due to their thin-wall construction allow at least 50 per cent. more wiring space than other fittings of similar type.

"Unilets," because of their lightness in weight, are easier for the workman to handle and save considerable in transportation charges and are far more durable and not subject to breakage as are the brittle, cast-iron fittings.

"Unilets" possess many points of superiority over and above other fittings now on the market and to know their true value is to try them on your next job. The conduit is steel, why not the fitting?



"Unilets" are fully described in our new and complete catalogue No. 7, also small booklet, both of which will be sent upon request. Do not delay, write us today, addressing Dept. "D".

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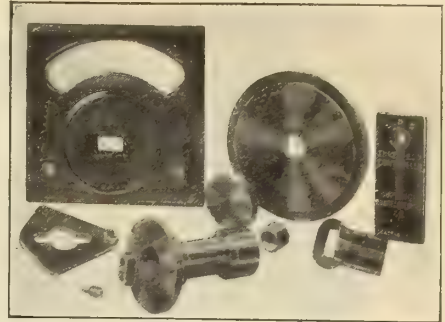
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Has a transverse strength of 13,000 lbs. per sq. in.



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Resists temperatures up to 300 deg. Fahr. And has a dielectric strength of 250 volts per mil.

Light in weight. Not affected by the action of water, oils, and other liquids. Cannot swell or shrink from moisture or alternate heating and cooling.

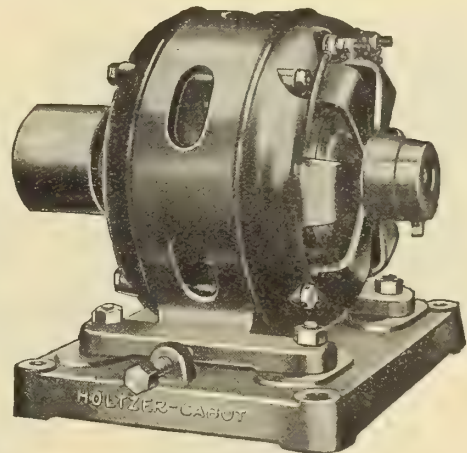
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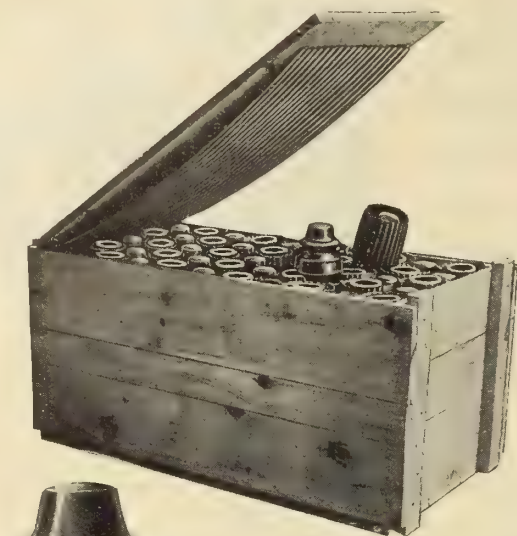
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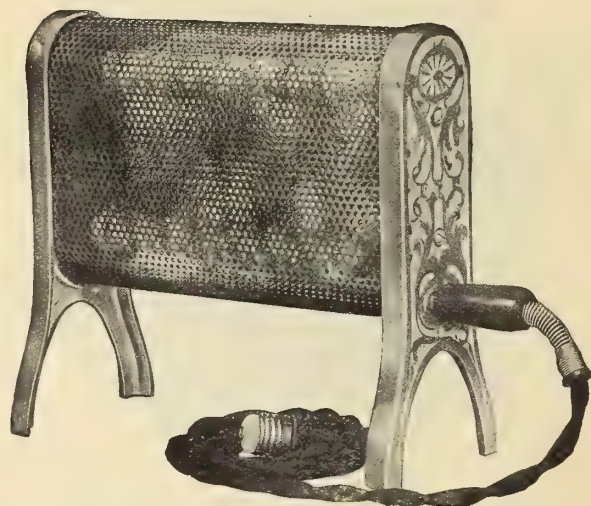


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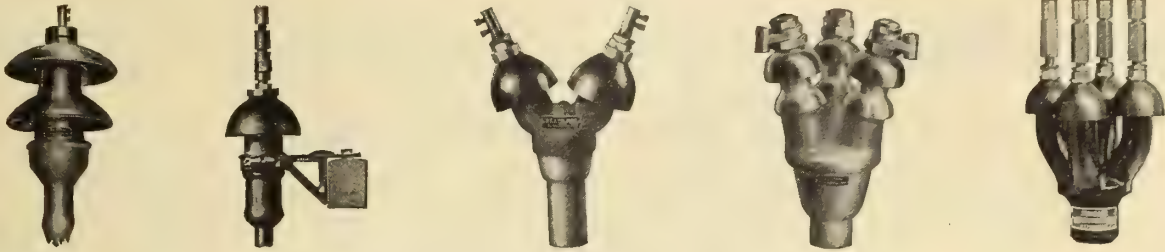
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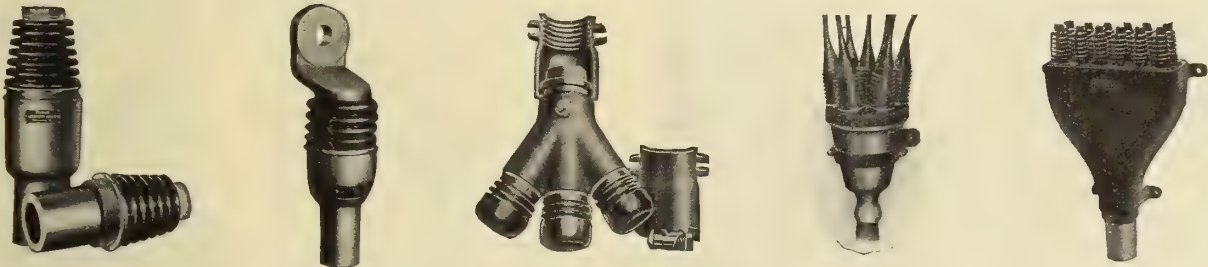
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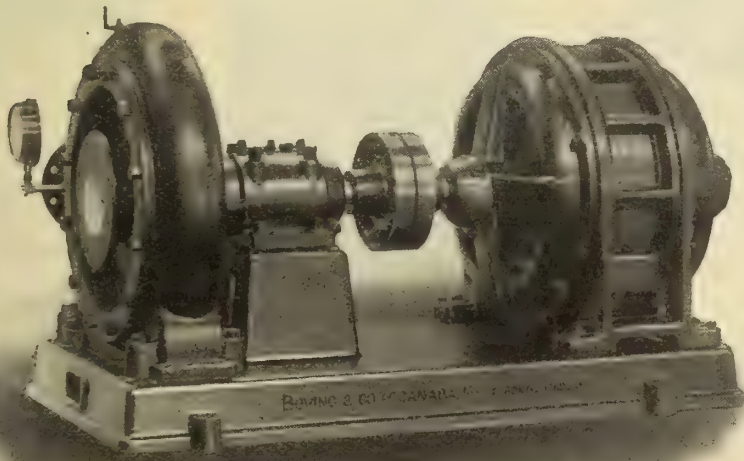
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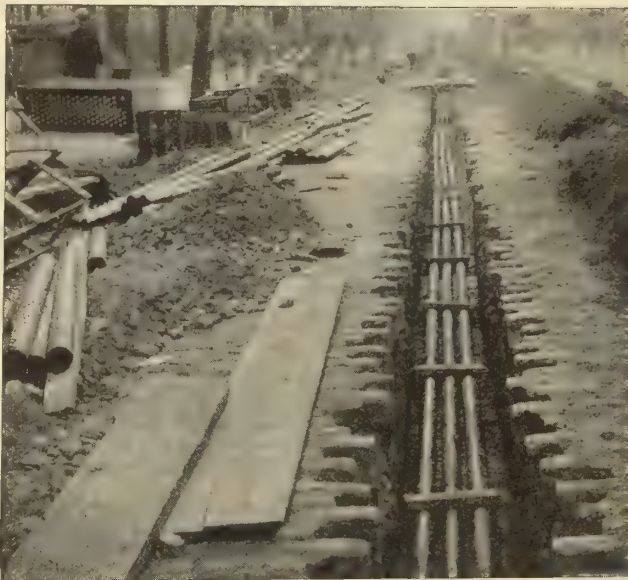
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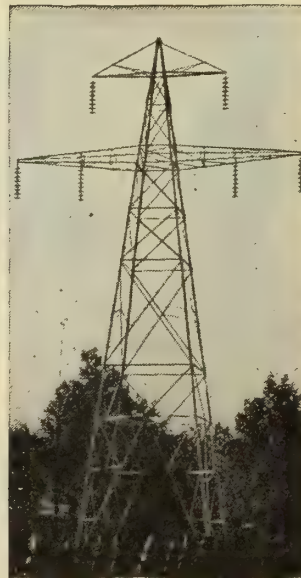
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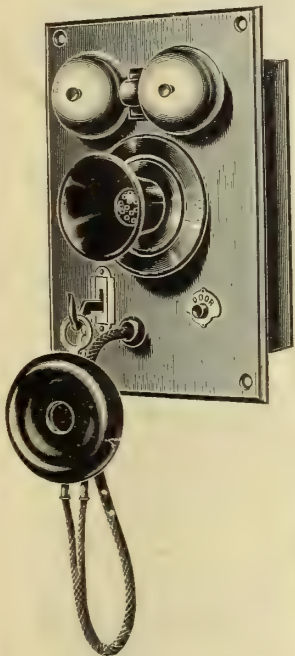
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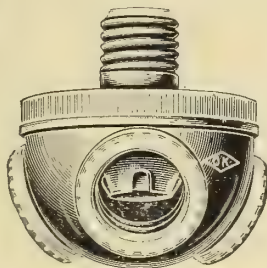
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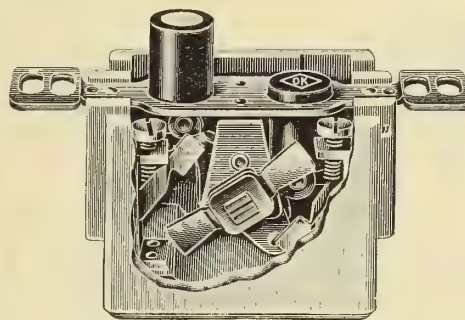
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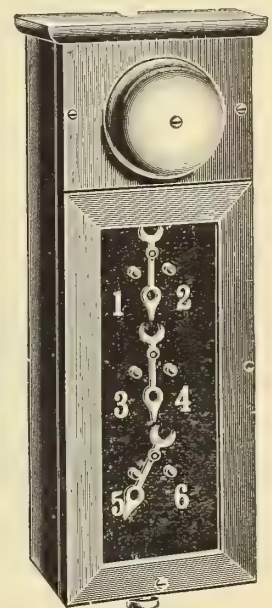
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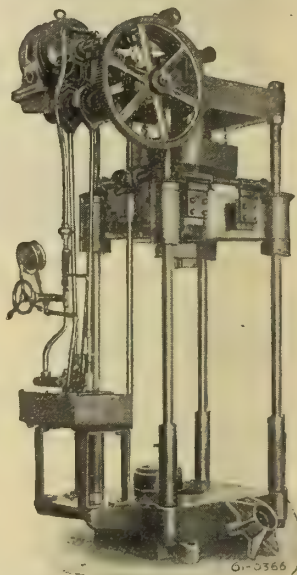
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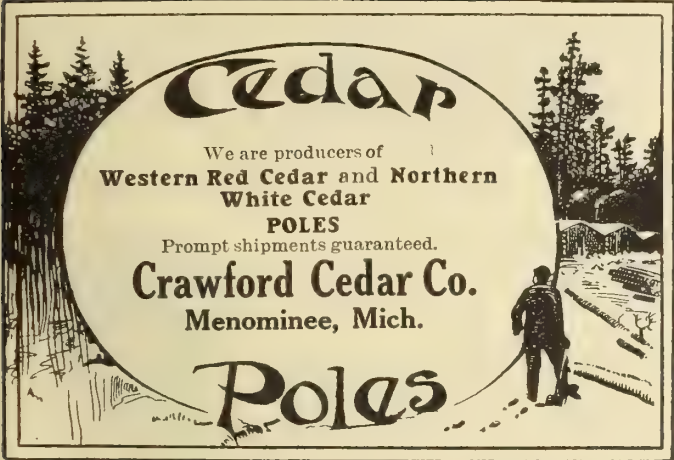
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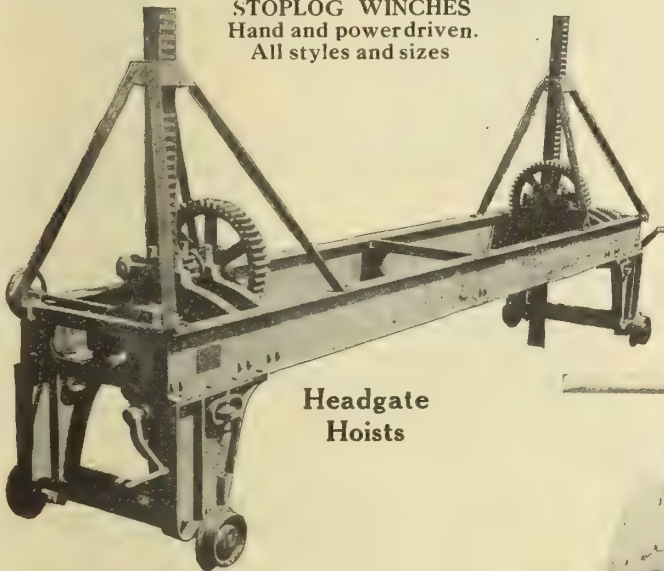
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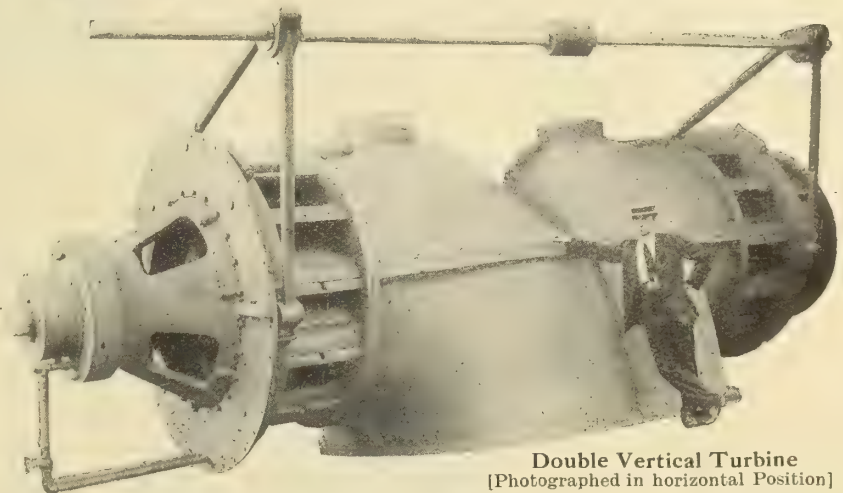
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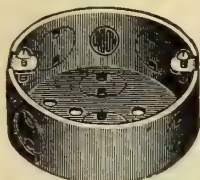
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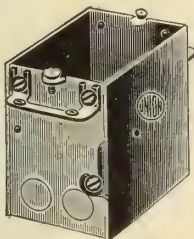


No. 103 Box

The "UNION" line of Outlet Boxes is complete; includes all the standard sizes and depths, with a full assortment of covers; adapted to accommodate the wiring devices of all manufacturers.

The "UNION" Sectional Switch Box is acknowledged to be the leader. Various depths and forms to meet every need.

"UNION" Boxes are for sale by all leading jobbers. Complete information in Box Catalog No. 27.



"DC" Box



**CHICAGO FUSE MFG. CO.**  
CHICAGO NEW YORK

# TRANSMISSION FIXTURES

We manufacture a complete line of wooden fixtures for transmission purposes, comprising

**Cross Arms, Insulator Top Pins  
Brackets, Pole Steps  
Strain Pins**

We make a specialty of Pins for High Voltage Transmission.

All our products are manufactured from carefully selected woods and are boiled in Parafin and Stearin or Creosoted if wanted.

We solicit your permission to quote prices.

**The Lachute Shuttle Co., Ltd.**  
Lachute Mills, Que.

Let Us  
**Light Your Factory**

*We make*  
**Motors and  
Generators**  
*For All Circuits*

WRITE

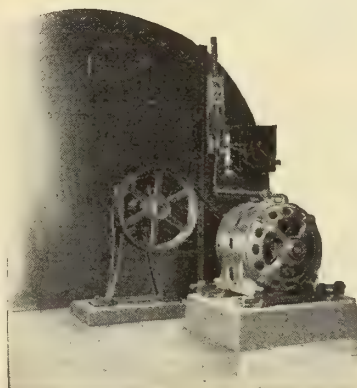
**Toronto & Hamilton Electric Co.**  
HAMILTON, ONT.

For driving Heating and Ventilating Fans, where quiet operation is necessary,

*Century*

**Single Phase Motors**

will be found superior.



Many manufacturers of such apparatus have pronounced them the most quiet of any on the market. They are particularly suited to remote and automatic control.

(7½ H.P. Motor connected to ventilating fan by silent chain)

1/6 to 40 H.P.—25 to 140 Cycles.

**Century Electric Company**

19th, Olive to Pine Sts. ST. LOUIS, Mo.

CANADIAN AGENTS

Jones & Moore Electric Co., Ltd.  
294 Adelaide St. W., Toronto  
Mainer Electric Co., Ltd.  
Winnipeg and Edmonton

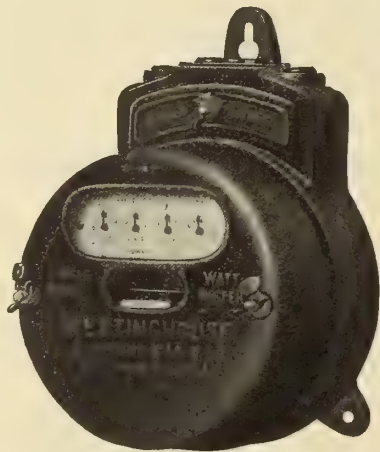
Rudel-Belnap Machy. Co., Ltd.  
Canadian Express Bldg., Mont  
Rankin & Cherrill  
547 Main St., Vancouver



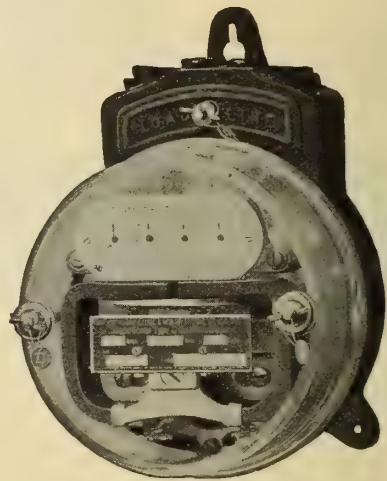
Years of Service have demonstrated the working qualities of

# **Westinghouse**

## **Type C Watthour Meters**



With metal case.



With glass case.

**T**HE merit and guarantee of long established standard design have proven their most important quality—accuracy over long sustained periods of service.

**Canadian Westinghouse Co., Limited, Hamilton, Ontario**

**Toronto**  
Traders Bank  
Bldg.

**Montreal**  
52 Victoria Sq.

**Ottawa**  
Ahearn & Soper,  
Ltd.

**Halifax**  
Telephone  
Bldg.

**Ft. William**  
Telfer Bldg.

**Winnipeg**  
158 Portage  
Ave., E.

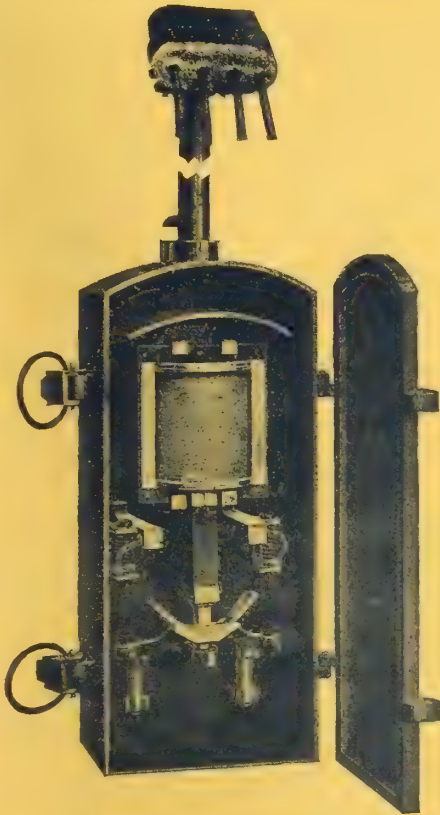
**Calgary**  
Grain Exchange  
Bldg.

**Edmonton**  
Dominion  
Bldg.

**Vancouver**  
Bank of Ottawa  
Bldg.



## Solenoid Switches for Remote Control of Street Lights



This cut shows our Type 17 H.E.P. Solenoid switch which was adopted by the Hydro-Electric Commission of the Province of Ontario and used by them in a large number of Ontario towns.

Orders are received from all the Provinces.

This switch is no experiment. The fact that it has been adopted by the Hydro-Electric is proof of its success.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

**Essential for Modern Street Lighting Methods. Let us send fuller particulars.**

## How About Your Electric Repairs?

We have expert repair men available at a moment's notice to make repairs at your plant or at our works. They have repaired some of the largest machines in the country.

*If you want complete, quick service, wire us.*

**The Electrical Maintenance and Repairs Co.,**

162 West Adelaide St., Toronto

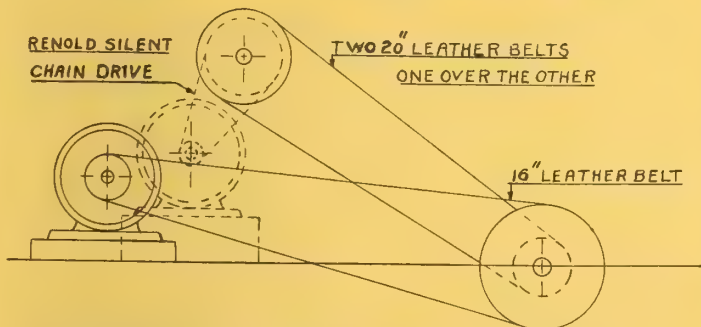
Phones—Adelaide 902-903

Nights—Beach 1723-1930

FOR ALL YOUR ELECTRICAL REQUIREMENTS

## Hans Renold Patent Liner Silent Chain

**"The Power-Saving Transmission"**



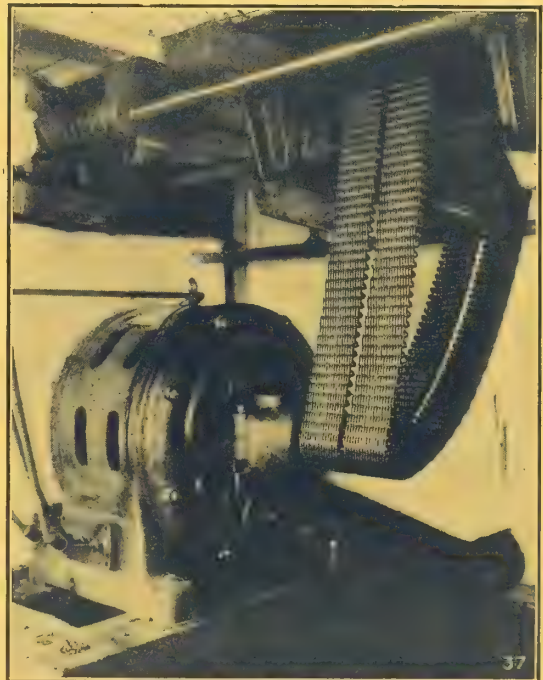
100 HP DOUBLE REDUCTION BELT DRIVE REPLACED BY

RENOOLD SILENT GEAR (SHOWN DOTTED IN.)

(43)

Intending users of Hydro-Electric Power **MUST LOOK** to the means of power Transmission. Otherwise tremendous losses will follow. The above cuts show a double reduction belt drive—with which the input to Motor was 125 h.p.—and the chain drive which substitutes it. With the chain drive the load on the lineshaft was increased and the input to the Motor reduced to 95 h.p. or 31 per cent. This saving at \$15.00 per h.p. per year amounts to \$450.00 regardless of increased production, saving of space, etc.

**Have You Any Such Losses?**



The Renold Chain Drive as shown in drawing opposite

**JONES & GLASSCO, Engineers,**

(Reg'd.)

Sole Canadian Agents

**MONTREAL**

Branch Office: TORONTO

*We stock Chain and Repairs*



# ELECTRIC REPAIRS

We can keep you running  
while we make your repairs

## FRED THOMSON CO., LIMITED

326-328-330 WEST CRAIG STREET

MONTREAL



### Safety and Rapid Restoration of Service Are One and the Same

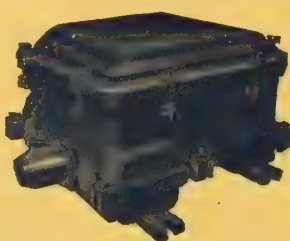
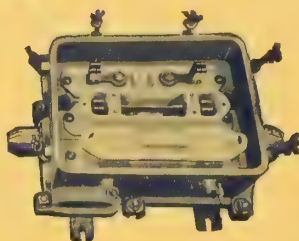
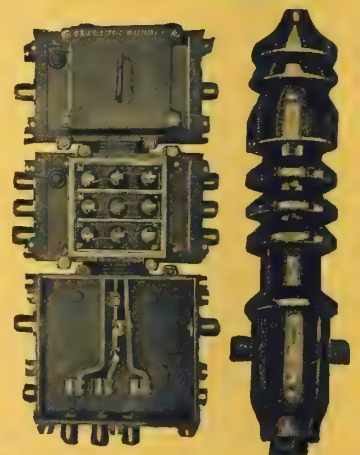
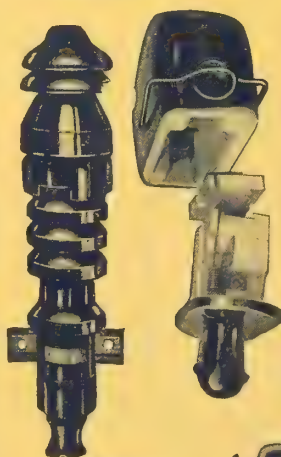


Rapid restoring of service necessitates a simple, completely thought out, standardized and executed scheme of taking care of trouble. This results in the selection of ONE DEVICE adaptable to all conditions; ONE DEVICE, the makeup of which shows to your linemen every time they see it, just what can be accomplished at that point. When trouble comes they know where to go, and when they get THERE, WHAT TO DO. Read the first four pages of our catalog No. 8 and note the three circuit diagrams in connection which illustrate such a scheme.

**G & W Electric Specialty Company**  
6308-10 Blackstone Ave., Chicago, U. S. A.

Canadian Representatives:

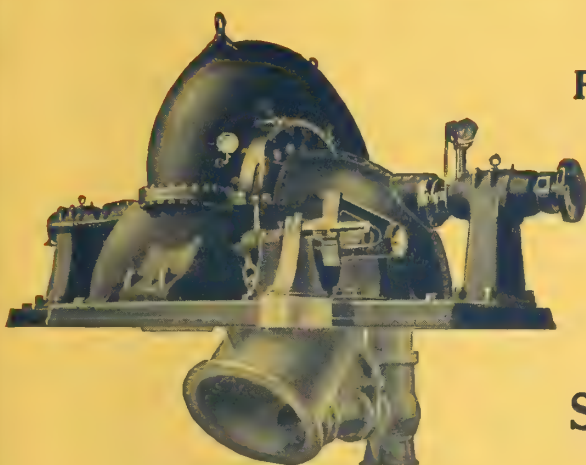
A. H. WINTER JOYNER Ltd., 76 Bay St., Toronto, Ont.  
BENTZ-RICHARDSON CO., Ltd., 114 Phoenix Bldg., Winnipeg, Man.  
GENERAL SUPPLIES, Ltd., Calgary and Edmonton, Alta.





# Electrical News

Generation, Transmission and Application of Electricity



5250 Horse Power 275 Feet Head

## 90% EFFICIENCY From SMITH HYDRAULIC TURBINES

Recent tests at Holyoke, Mass. of Smith Turbines have again proven their superiority over any turbine now manufactured.

These tests showing efficiencies from 89% to over 90%.

We design and build turbines for heads from 5 feet to 650 feet.

*Send for Bulletin N*

**S. Morgan Smith Co., York, Pa.**

Branch Offices: 176 Federal St., BOSTON, MASS.  
614 American Trust Bldg., CHICAGO

If you use or handle flashlights insist upon the genuine EVEREADY with EVEREADY Tungsten EVEREADY batteries and EVEREADY Mazda lamps.

## "Canadian Made for Canadian Trade"

*A post card request will bring new catalog B225.*

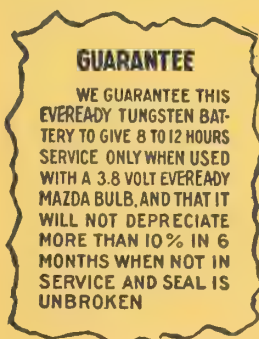
**This is Your Protection.**



No. 2633

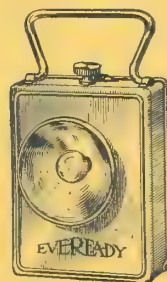


No. 6991



### GUARANTEE

WE GUARANTEE THIS EVEREADY TUNGSTEN BATTERY TO GIVE 8 TO 12 HOURS SERVICE ONLY WHEN USED WITH A 3.8 VOLT EVEREADY MAZDA BULB, AND THAT IT WILL NOT DEPRECIATE MORE THAN 10% IN 6 MONTHS WHEN NOT IN SERVICE AND SEAL IS UNBROKEN



No. 4706



No. 4716

## Canadian EVEREADY Works

of Canadian National Carbon Company, Limited, TORONTO, Ontario



# MADE IN CANADA

*Packard*

## METERS

### *Accurate Recorders of Electric Currents*

The achievements of Packard Meters in the past fourteen years firmly establishes the truth of this statement and recent re-inspections of the Government furnishes the federal truth.

With every Packard Meter goes the reputation of a firm whose name in the past has become a by-word for meters—PACKARD.

Packard Meter service means a reliable meter service—what is it worth to you to know you can depend on your meters? Isn't it worth an investigation?

*Let us send you more detailed information.*

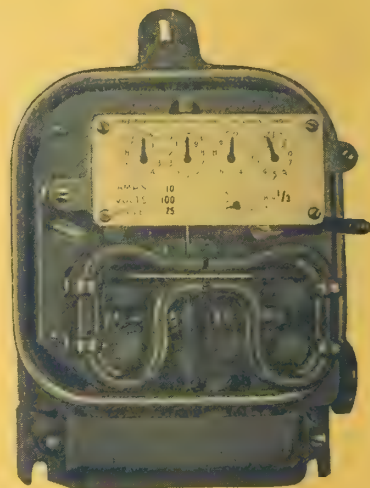
The **Packard Electric Co., Ltd.**

Factory at St. Catharines, Ont.

General Sales Office, N. W. Office and Warerooms  
Traders Bank Bldg., TORONTO WINNIPEG

LARGE STOCKS CARRIED AT

St. Catharines and Winnipeg; St. John Railway Co., St. John, N. B.;  
General Supplies, Limited, Calgary, Alta.;  
Rudel-Belnap Machinery Co. Canadian Express Building, Montreal, Que.





Both in Knife blade and ferrule types  
Dominion made

# **ECONOMY** Renewable Cartridge **FUSES**

are now available in all capacities, in their improved form, marking a new era in fuse manufacture.

At last the industry is given a high capacity renewable cartridge fuse operating successfully under all conditions of service without filling material of any description. The results obtained are due to the employment of a distinctive and new type of fuse element—the Economy “Drop-Out” Renewal Link—a feature exclusively employed in Economy renewable cartridge Fuses.

The absence of powdered filler eliminates the uncertain performance and varying ratings found in fuses in which the use of filling material is necessary. Briefly, here are some of the faults charged up against powder-filled fuses: The filler may be omitted by a man in the field who attempts to renew fuses; the filler, even when placed in the fuse by the manufacturer, is variable in density; the filler is often tightly packed from the effects of vibration, permitting the fuse to operate at a point other than the one intended by the design; the filler may be so tightly packed that the molten fuse metal on operation will continue to carry current indefinitely; the filler may absorb sufficient moisture to be converted into steam on operation, or to set the mass into solid form, and either consequence is attended with abnormal results when powder-filled fuses operate under such conditions.

Now contrast these uncertain operating performances with the sure results secured when ECONOMY renewable cartridge Fuses protect your circuits:

The entire volume of the fibre shell is unoccupied except by the Economy “Drop-Out” Renewal Link. The liberal air space thus provided permits a rapid gas expansion, but with low resultant pressure due to the small amount of metal in the “Drop-Out” Link which is volatilized by operation. No end-holes allow direct venting of fire, as the gases liberated are restrained by the resilient and metal end-washers which entirely close that portion of the fuse, permitting the gases to escape only by the path provided by the clearance of the threads under the brass cap. In addition, the centering washer system aligns and centers the blade members and allows flexibility sufficient for the adjustment of the blades to the clips into which the fuse is inserted and therefore to give good, uniform contacts on both sides of the blades.

*Prove at our expense that Economy renewable cartridge Fuses save 80% per year of fuse cost over the expense of using, old style, non-refillable fuses. Write for samples to fit your circuits.*

## **Economy Fuse and Mfg. Co.** of Canada, Ltd.

Unity Bldg. . . . . Montreal

*Manufacturers in Canada of “S & C” Extra High Potential Fuses—to 150,000 volts.*





# **LACO LAMPS LEAD**

---

## **QUALITY**

Made under Government specifications.  
Exclusively used by the largest central  
stations, railroads and distributors.

The most efficient and complete line of  
High Efficiency Gas Filled Lamps in  
the World.

## **SERVICE**

Complete stocks all standards and sizes  
in Montreal, Toronto, Winnipeg and  
Vancouver Warehouses.

## **PRICES**

Always competitive.

**Canadian Laco-Philips Co., Ltd.**

**Montreal    Toronto    Winnipeg    Vancouver**

**LACO LAMPS LAST LONGEST**



# Sunbeam Mazda Lamps

Let  
**Canadian Lamps**  
Make  
**Canadian Current**  
Into  
**Canadian Light**  
For  
**Canadian People**

**I**N these times of war we can each do our share to help the financial affairs of the Dominion by buying only "Made-in-Canada" goods.

When it comes to the question of lamps, you should always "boost" Sunbeam Mazda Lamps. In addition to being a "Made-in-Canada" article they are superior to any imported lamp, being more rugged in construction and giving a better light.

Send us a trial order and let it be proved that "Sunbeam" Mazda lamps are all we claim for them.

## Canadian Sunbeam Lamp Co.

Limited

Main Office and Factory: TORONTO

—Branch Warehouses—

Montreal

Winnipeg

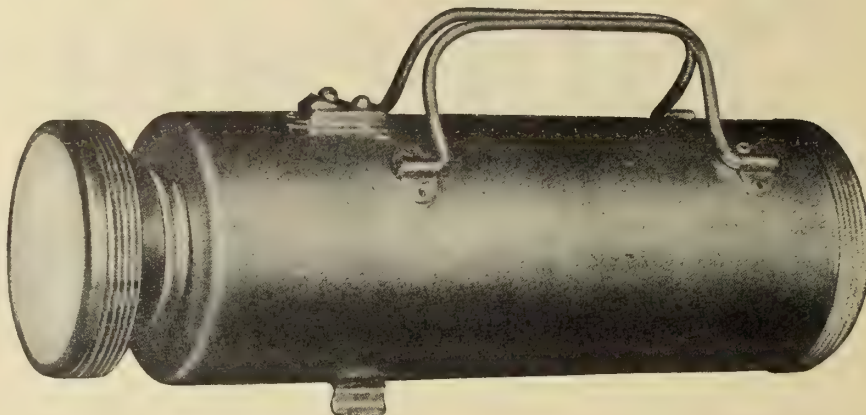
Calgary

Vancouver



# ANNOUNCEMENT

100  
hours of light  
for  
25 cents



Reliable  
Safe  
Economical  
Durable

Send in your orders, at once, for C-BE-CO Electric Hand Lantern. Operates on an ordinary No. 6 dry cell.

## CHAS. B. ELLIS COMPANY

C-BE-CO Electrical Specialties and Supplies

Sole Distributor for Dominion of Canada (of the Beers Lantern)

301 Power Bldg.

MONTREAL

### Griffiths Bros. & Co., London, Eng.

#### "Anti-Sulphuric" Enamel

The only reliable protection against the action of acid and chemical fumes.

#### "Armacell"

Possesses the highest insulating qualities of any varnish on the market.

#### "Ohmaline"

Black, Quick, Air-Drying insulating composition, Also supplied for stoving and as a solid insulating compound.

#### "Driorol"

Oil-proof Enamel. Dries quickly over greasy or oily surfaces, not affected by lubricating oils.

#### "Shaydolite"

For coloring electric lamps. Used in the Royal Navy. Weather proof. Dries rapidly.

#### "Ferrodor"

Rust-proof elastic paint. Superior to Red Lead or Graphite.

### New British Ever Ready Electrical Co.

"B-E-R-E-C" Portable Electric Specialties.

### Canadian Ever Ready Co.

EVEREADY Specialties.

### Bastian Electric Heaters

"Real Red Heat"

### British Aluminium Company

### Falkirk Iron Company

Scotland

Electric Stoves and Cooking Apparatus.

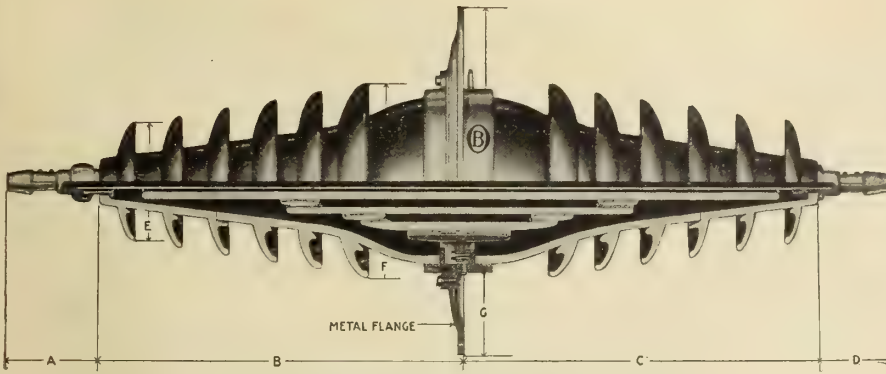
WRITE FOR CATALOGUES TO

## Spielmann Agencies, Regd.

205E Read Building, St. Alexander Street

Montreal





No. 11909 - Wall Insulator - Working Voltage, 150,000  
A=9; B=39½; C=39; D=7½; E=13½; F=22; G=40 inches.

## O-B Wall and Roof Insulators

Designed and manufactured with that careful attention to detail so necessary for reliable service. The O-B watchword "*Quality First*" is never lost sight of.

**The Ohio Brass Co.**  
Mansfield, Ohio, U. S. A.

British Made

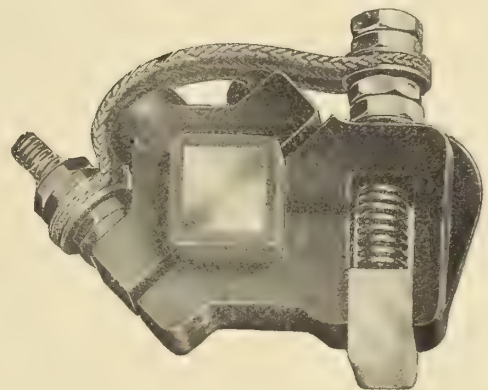


Motor Control Gear



←  
*The Starter*  
and  
*Its Finger*  
→

E.A.C. Auto transformer starters have real drum type switches with heavy copper to copper contacts. These contacts are renewable. The steps are progressive and the starter cannot be left with the transformers in circuit.



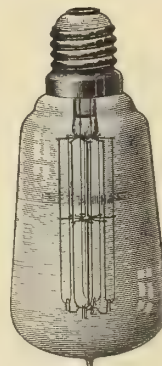
**The Electrical Apparatus Co., Ltd.**  
Vauxhall Works:—South Lambeth Rd.  
LONDON S.W., ENGLAND

Telegrams:—Elapratu, London. ABC Code, 5th Edition

## ALUMINUM ELECTRICAL CONDUCTORS

Ingot Sheet Wire Rod Tubing

**Northern Aluminum Co. Limited**  
1305-6 Traders Bank Bldg.  
Toronto, Ont.



P. O. Box 1513

## GWIAZDA

TUNGSTEN LAMPS  
Wire Drawn

One watt per candle power  
in all sizes. Best Quality

in stock at

**G. LEWIS**

Sole Agent

3 St. Nicholas St., MONTREAL

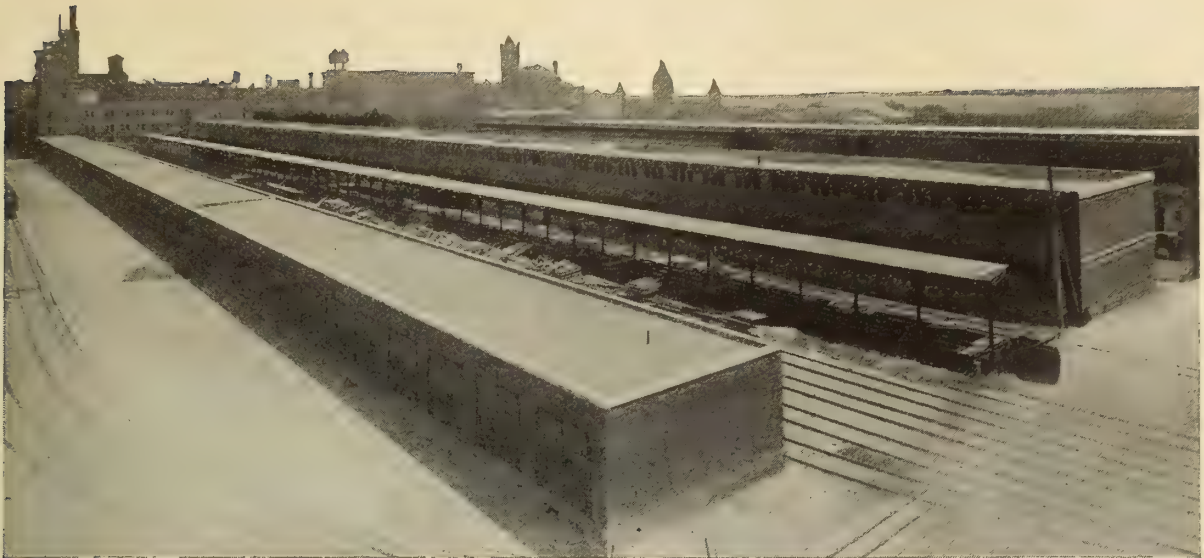


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C. P. R. Freight Sheds, Toronto. "Galvaduct" Bldgs.  
Hutchinson, Wood & Miller, Architects.

### "GALVADUCT"

The most perfect interior construction conduit on the market.  
Recognized as the standard of high quality.

Always specify "Galvaduct" or  
"Loricated" Conduits

### "LORICATED"

A high-class interior construction conduit of the enamelled  
type, proof against acid or other corrosive agents.

If your jobber cannot supply  
you—write us

Use "Made In Canada" conduit to  
carry your electric wiring safely  
through your buildings.

Used everywhere in Canada.

**Conduits  
Company  
Limited**

**Toronto - Montreal**

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D**



Made in Canada



**MOONSTONE GRECIAN LAMP**  
specially adapted for the new  
**NITROGEN LAMP**

No. 9070	-	7 inch	diameter
No. 9072	-	10 "	"
No. 9074	-	12 "	"
No. 9076	-	14 "	"
No. 9078	-	16 "	"

Good Lighting is entirely a matter of the selection of the proper Glass-ware.

**Moonstone Glass** meets the requirement of every service. In the many beautiful designs to choose from careful consideration has been taken to the efficiency of every piece.

Our Engineering Department will gladly assist you with your lighting plans.

## Jefferson Glass Co., Limited

Head Office and Works, TORONTO

Branch Sales Offices, Montreal, Winnipeg, Vancouver



## XCELADUCT means

*Satisfaction for the Engineer  
Satisfaction for the Electrician  
Satisfaction for the Customer*

**THE  
CONDUIT  
OF NO  
REGRETS**

### XCELADUCT

Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by **COPPER-PLATING** and zinc coating.

Clean threads and smooth enamelled interior allows rapid fishing.

### ORPENITE

Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

# Orpen Conduit Company, Limited

TORONTO

ONTARIO



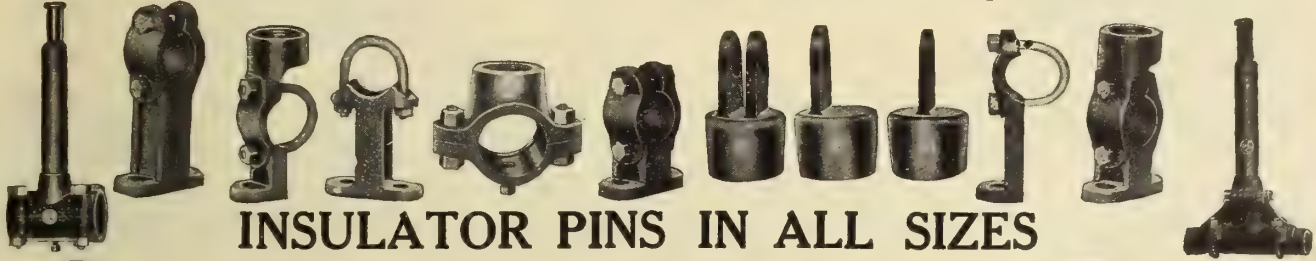
# General Devices & Fittings Co.

*Designers, Engineers, and Manufacturers of*

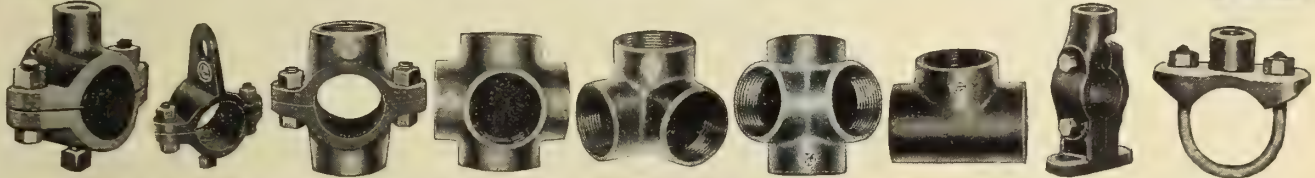
## MALLEABLE IRON FITTINGS

SOLID AND CLAMP TYPE FOR IRON PIPE, SIZES UP TO 2 INCHES IN STOCK

Switchboard Supports made for 2½ inch, 4½ inch and 6 inch centres,  
Also made with feet on both ends. All sizes Floor Flanges stocked



INSULATOR PINS IN ALL SIZES



817-25 W. WASHINGTON BOULEVARD

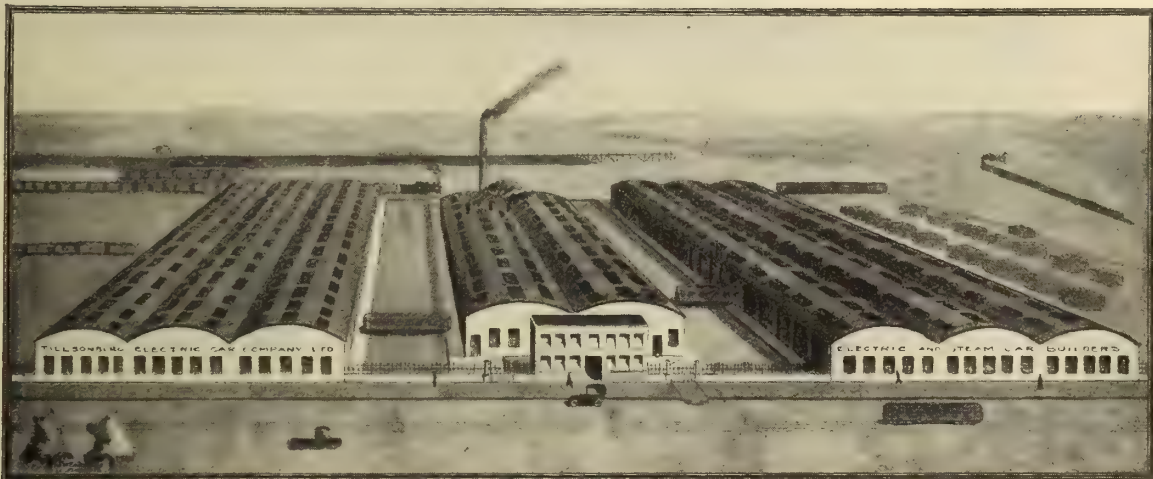
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CHICAGO, ILL., U. S. A.

Benz-Richardson Co., Limited, Winnipeg Sales Agents, 114 Phoenix Block, Winnipeg, Man.  
Toronto, Ont., Ontario Sales Agent

A. H. Winter-Joyner Ltd., 76 Bay St.,  
Roper, Clarke & Co. Ltd., Coristine Bldg., Montreal, Que., Montreal Sales Agent



## The Tillsonburg Electric Car Co., Limited

*Manufacturers of*

### ELECTRIC CARS, SWEEPERS AND SPRINKLERS

Orders for electric cars are now coming in fast and building operations are in full swing.

Will you need new equipment for summer delivery? If so get in touch with us as soon as possible in order that you may rely on getting your cars when needed.

Office and Works,

-

-

Tillsonburg, Ontario



# *Northern Electric Inter-phones*

—a profitable line  
to handle



—make it your business

to see that every business house in your city that boasts  
of more than two departments is equipped with

## *Northern Electric Inter-Phones*

It is profitable business to secure—and easy to develop.  
Our nearest house will give you all the help you will accept.

*Northern Electric Company*  
LIMITED

MONTREAL	HALIFAX	TORONTO	WINNIPEG
REGINA	CALGARY	EDMONTON	VANCOUVER
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New style Navy Type  
Air Heater



TRIANGLE LEKTRIK  
Curling Iron Heater

## Practical Gifts Sell Best

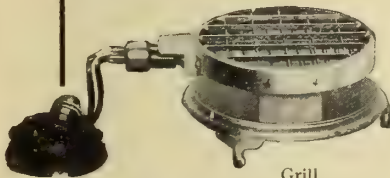
**W**ITHIN two weeks Christmas buying will start in earnest. This season will see a change on the part of the buying public. Business conditions will make it imperative to discriminate in favor of articles having the most practical value and highest quality.

Because of the usefulness of an electric iron, a toaster, a grill, a percolator, a chafing dish, an air heater, or a curling iron heater, electrical dealers have the big advantage over other retailers in capturing a very large share of the Christmas trade.

Each of our houses have complete stocks of everything suitable for the electrical Christmas Gift Season, ready for immediate shipment. The lines carried are absolutely the highest quality and are backed by the oldest and largest exclusive heating appliance manufacturers as well as ourselves.

We have a very complete and most effective line of selling helps. They consist of illustrated folders, posters, cut-outs, "movie" slides and an Xmas window display suggestion that we consider a corker; it is simple and easy to reproduce yet most effective.

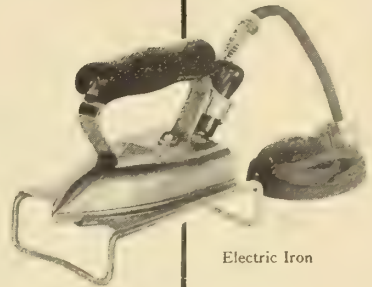
**Write our nearest house to-night—  
If you don't your competitor may.**



Grill



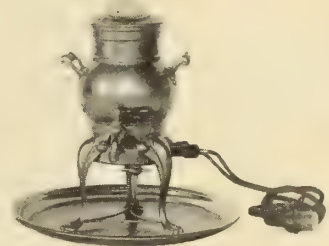
Curling Iron Heater



Electric Iron



Toaster



Coffee Percolator



Chafing Dish

# Northern Electric Company

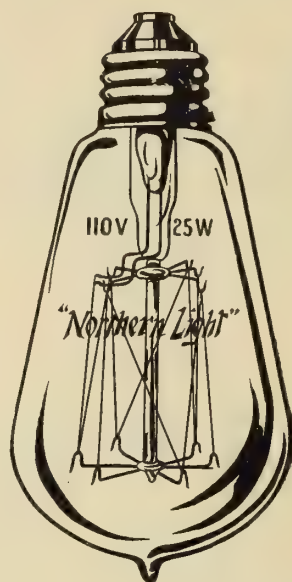
LIMITED

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TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA





# *Northern Light*

## MAZDA LAMPS

"They Light The Way" to greater satisfaction on the part of your customers—to greater profit for you.

Built rugged—tested true—packed five a carton.

Mazda Lamps give three times the light for the same current

—or the same light with one third the current used by carbon lamps.

Northern Light Mazdas sell three times as fast for the same effort

—or just as fast with one third the effort that you have to put behind less favorably known lamps.

**MADE IN CANADA**

*Northern Electric Company*  
LIMITED

MONTREAL	TORONTO	HALIFAX	WINNIPEG
REGINA	CALGARY	EDMONTON	VANCOUVER
			VICTORIA





# Nickel

Shot, Ingots (3 sizes) Electrolytic (99.80% Ni.)  
Wire, Rods and Sheets

Metallic Nickel of our production is Prime Metal for manufacture of Nickel Steel, German Silver, Anodes, and for all alloy purposes.

Malleable Nickel of our production is successfully rolled and drawn as sheets, rods, strip stock and wire. A recent development is its use as filament supports in the new nitrogen filled Tungsten Light.

*Send your inquiries direct to us*

**The International Nickel Company**  
43 Exchange Place, New York

# Pole Line Hardware

That Stands the Test of Time and Weather

WE MAKE ALL ARTICLES REQUIRED

**WIRES: Copper---Galvanized for Electrical Construction Work, etc.**

**ALL STYLES OF: Bolts, Nuts, Rivets, Washers and Screws, Pole Steps, Guy Clamps, Cross Arm Braces.**

Send us your specifications to quote on.

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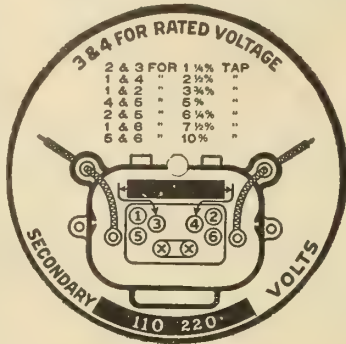
Lowest Prices---Prompt Shipment.

The **Steel Company of Canada, Limited**

Hamilton Montreal Toronto Winnipeg Vancouver Victoria St. John, N.B. Halifax



Brass plate twice the size as in cut, showing terminal block and compensating taps obtainable, is securely fastened in all covers of Moloney Type "H. E." Pole Type Service Transformers. These plates can not be LOST, DEFACED or made UN-READABLE through use. This is one of the substantial methods used on



# MOLONEY

## Satisfaction

# TRANSFORMERS

MADE IN CANADA

**Moloney Electric Company of Canada, Limited**  
WINDSOR, ONTARIO

General Sales Office—Traders Bank Building, TORONTO

MONTREAL

WINNIPEG

Branch Offices

CALGARY

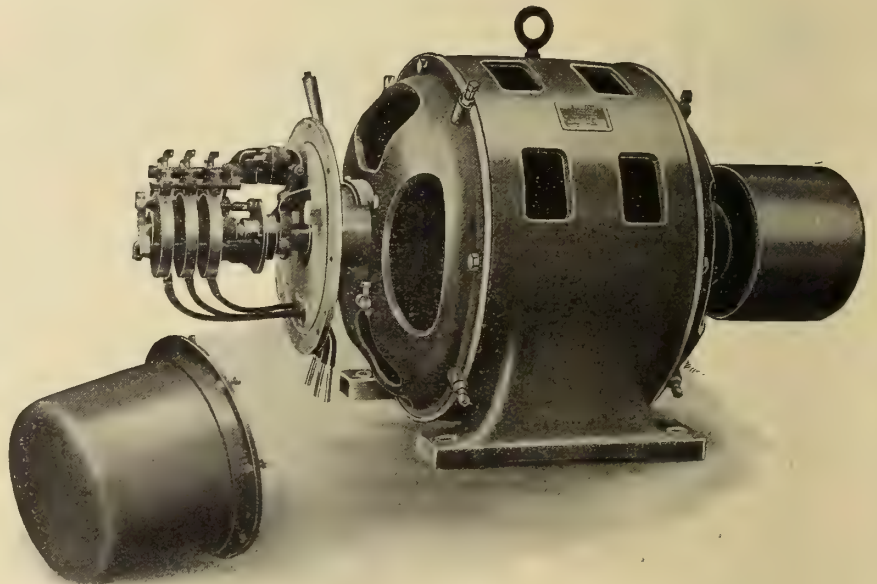
VANCOUVER

# Peebles

# Motors

Large Stock of  
A. C. and D. C.  
Machines

Highest Workmanship.  
Attractive Price.



**FERRANTI ELECTRICAL COMPANY OF CANADA**  
**LIMITED**

90 Sherbourne St.  
TORONTO

Farmers Advocate Bldg.  
WINNIPEG





## Our New Catalog Is Ready

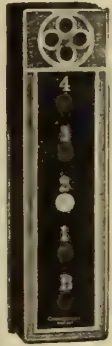
**CONNECTICUT**

### Interior Telephones

Just off the press—this new Catalog No. 23 of ours is full of money-making information. It's a valuable reference work with

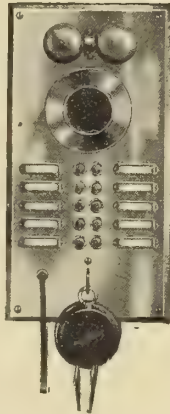
splendid cuts of our big line of interior telephones.

## Electric Reset Annunciators



Connecticut Electric Reset Annunciators have made a splendid reputation for efficient, lasting service. They are made of the best material by skilled workmen and sell at a price which allows the dealers to make good profits. Twenty years of manufacturing back of them.

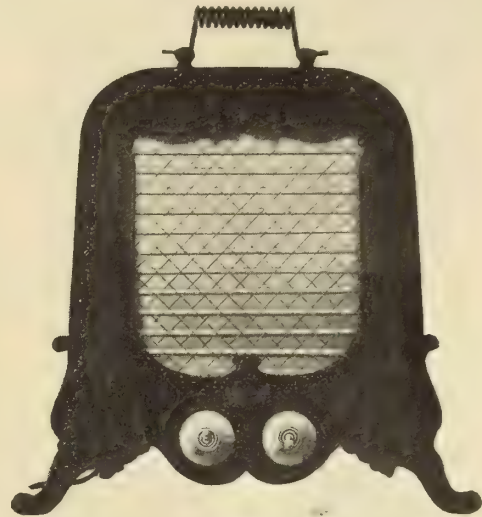
Write for the Catalog—23 C and special agents' propositions to handle the line in your city.



**Connecticut Telephone & Electric Company, Inc.**  
Meriden, Conn., U. S. A

## BASTIAN HEATERS

(ENGLISH PATENTS)



The Electric Heater that HEATS.

### NEW FALL FEATURES:

- 1.—Rodolite Glowers—increased capacity.
- 2.—Mantel Type Bastians for fireplaces.
- 3.—Flush Type Bastians for recesses.

Be ready NOW to DEMONSTRATE BASTIAN HEATERS.  
They Sell Fast.

## THE MASCO COMPANY

Distributors

LIMITED

58-60 Church St., Toronto

"Jobbers of Standard Electrical Goods"

## High Grade Electric Fixtures

### Fixture Parts

Pans

Loops

Chain

Canopies

Etc.



Send us your  
next order

We can  
save you  
money

**H. W. KNIGHT & BRO.**

TORONTO, ONT.



WITHIN  
EASY  
REACH  
OF ALL

WRITE

**Monarch Electric Co., Limited**

St. Lambert, P. Q.

Get the Habit  
ask for

## Monarch Pull Sockets

Why

Only Pull Sockets  
should be used with  
Tungsten Lamps.

### Monarch Pull Sockets

Designed, Patented and

Made In Canada.

If your Jobber  
does not stock

**Monarch  
Pull Sockets**





## Hubbell Attachment Plug 5815

Increase your electrical activity—sales and profits—by putting Plug 5815 on all your devices. Because 5815 is interchangeable with all wall sockets and flush receptacles in the new Hubbell Line.

Greatest device convenience comes from 5815 interchangeableness. Preach this feature and receive the profits.

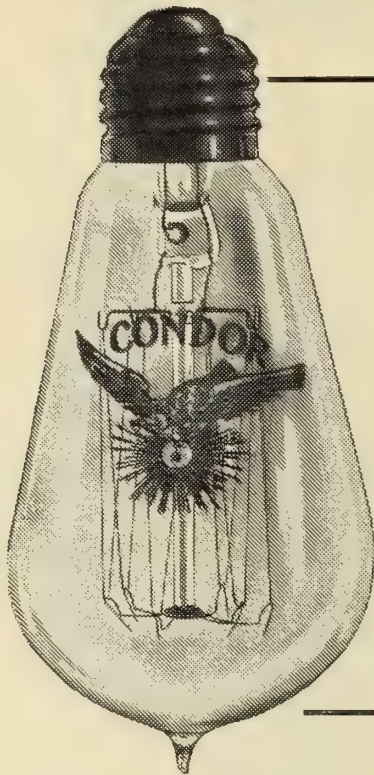
Greatest device safety comes from 5815 concealed contacts — another exclusive feature of this Hubbell Attachment Plug.

Complete line of Hubbell goods on hand in Canada for quick delivery

**R. E. T. PRINGLE**  
New Birks Building, MONTREAL



# "CONDOR" LAMPS



## THE WAR—and Its Effects on "Condor" Lamps

Or to be more exact we should have said "its non-effect" for despite the magnitude of the European situation we are able to get regular shipments in large quantities. This will enable us to give every "Condor" dealer an unlimited supply in all sizes at short notice.

No order too large—no order too small.

Mail orders receive extra special attention.

**Get Our Prices.**

Sole Canadian Distributors

**C. H. BASTERS & Company**  
22 College St., TORONTO, CANADA

*Always Reliable*

## Tenders

A few dollars spent in advertising your proposals in the

### Contract Record and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

## FELTS

Dust and Oil Rings, Buffers, Lubricating Pads, Wicks for Fan Motors, and felts of every kind for electrical and mechanical uses.

**The Booth Felt Co., Limited**  
GANANOQUE, ONT., CANADA



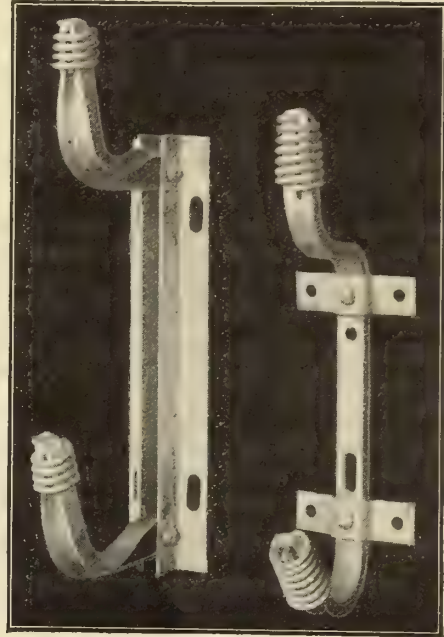
# Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

**Contract Record  
and Engineering Review**  
Toronto Ontario

## SHERIDEZED POLE-LINE HARDWARE

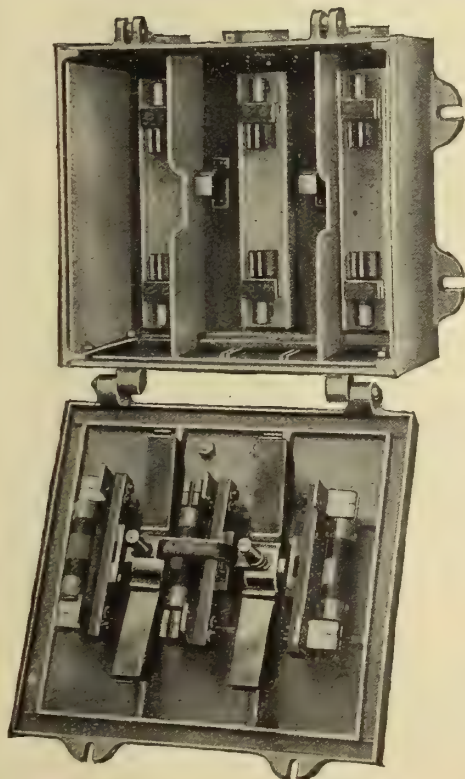


Write for our Prices

**R. E. T. PRINGLE**

95 King Street East  
TORONTO

901 New Birks Bldg.  
MONTREAL



## The FIRE HAZARD

Do not think only of loss by fire, but guard your employees against electrical accidents.

### BERRY'S PATENT

ironclad fuse-switch gear is used in every civilized part of the world, and is absolutely foolproof.

Write for particulars to the sole agents in your territory:—

**FEDERAL ENGINEERING CO., Limited**

90 Sherbourne Street, TORONTO

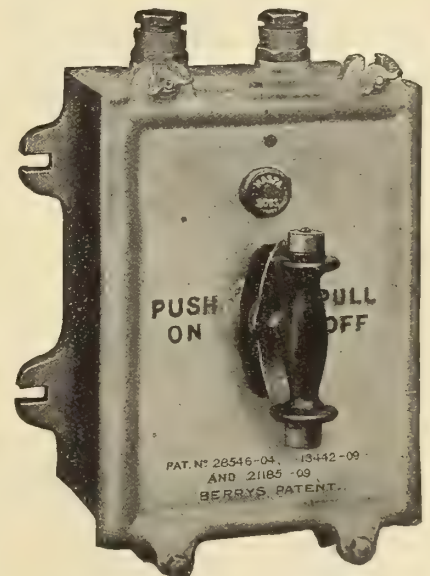
**GENERAL SUPPLIES, Limited**

122 Eleventh Avenue West, CALGARY

**CANADIAN-BRITISH ENGINEERING Co., Limited.**

324 Smith Street, WINNIPEG

T. P. "Masta" Patent Fused-Switch with  
National Standard Code Fuses.



D. P. "Masta" Fused-Switch  
Weathertight Type.

**Berry, Skinner & Company, 78 Upper Thames Street, London, E. C., England**



# EUREKA

## Increased Sales Reduce Price \$5.50

Because it is the best portable cleaner, as proved by five years' steady use, the Eureka has prospered. Its sales have grown to colossal proportions and its popularity is nation wide.

Because of the large quantities of Eureka's that we are selling, a reduction in price has been possible.

The Eureka is now selling retail for \$39.50 East of Winnipeg and for \$44.50 in Winnipeg and the West. This means a reduction of \$5.50.

Complete set of attachments \$10.00 extra.

Write us for dealers' proposition.

## Onward Mfg. Co.

Berlin, Ont.



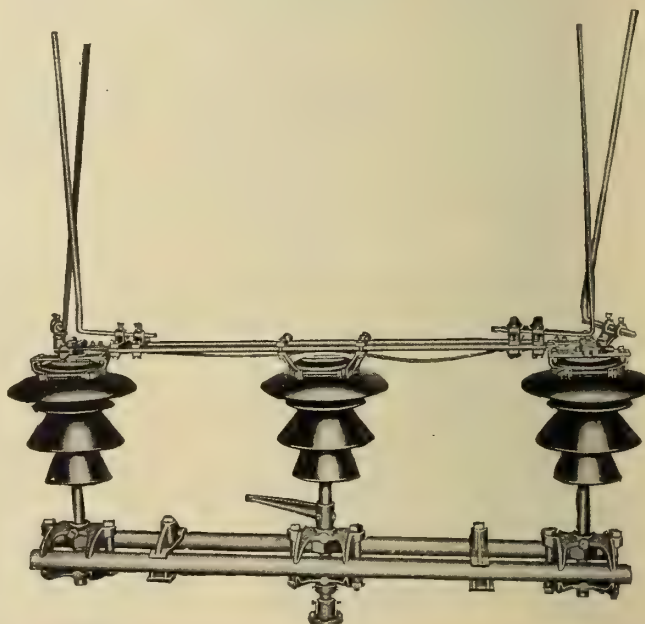
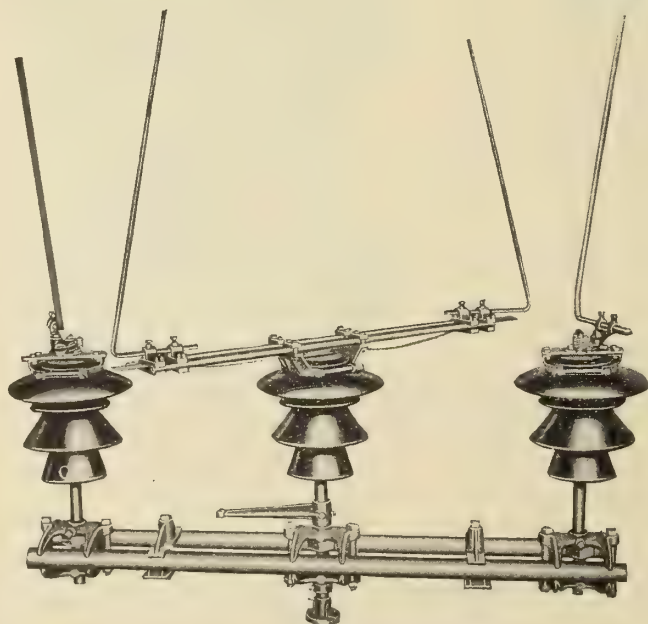
POWER PLANT LAYOUT

*If it is anything regarding*  
SUB-STATION LAYOUT

SWITCHING EQUIPMENT

Put the question up to our Engineering Department

We will give you the most modern and economical solution of your problem and our supply department is equipped to ship any order the day it is received.



WRITE FOR OUR NEW BULLETINS

## Electrical Engineers Equipment Company

711-715 MERIDAN STREET, CHICAGO, ILLINOIS

*Northern Electric Company*  
LIMITED

Montreal Halifax Toronto Winnipeg Regina  
Calgary Edmonton Vancouver





Published Semi-Monthly By

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### ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

### SUBSCRIBERS

The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for \$2.00 per annum. United States and foreign, \$2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Authorized by the Postmaster General for Canada, for transmission as second class matter.

Entered as second class matter July 18th, 1914, at the Postoffice at Buffalo, N.Y., under the Act of Congress of March 3, 1879.

Vol. 23

Toronto, November 15, 1914

No. 22

## What is Being Done?

Following our discussion, in the November 1st issue of the Electrical News, of the fatality in St. Catharines, we have been advised by the Hydro-electric Power Commission of Ontario that everything possible in the way of moral suasion has been and is being done to have the various distributing systems throughout the province properly protected by grounding. Whether anything more than this is being done we have not learned, but if not it would appear that the seriousness of recent developments would justify active and aggressive measures to reach the desired end. It may be true enough that, legally speaking, failure to punish neglect on the part of a private company to comply with a law does not relieve that company of the consequences, but still, in the mind of the average layman, that company has a pretty good excuse. Such an excuse would carry ten-fold more weight too, if it should happen to be shown that the Ontario Commission, the administrator of its own law, were itself breaking the law in operating one or another of its own systems still ungrounded.

This matter has surely been hanging fire long enough, and enough lives have been sacrificed in both private and municipal plants throughout Ontario, to justify enforcement of the most stringent orders. If the Hydro-electric Power Commission of Ontario does not take the matter up, then the act should be administered direct by the government—and with an iron hand—whether municipality or private company is concerned. It is not a matter at all of private company opposition. Both private companies and municipalities are offending and as a matter of fact the private companies are

eager enough to carry out any improvement which will relieve them of such heavy liabilities as they are often called upon to assume through such accidents as the one in question. Quite aside from that too, private companies are composed, in certain cases at least, of very human beings, who show quite as much respect for the lives of their employees as the municipalities do. Why then the delay? Why not do something, at once, to guarantee our citizens against such unnecessary and heart-rending tragedies as we have witnessed so often in the last five years?

## Ready for the Next Step

The Canadian Government has taken a stand that is unanimously approved in Canada, in prohibiting the export of nickel to any point in the world where it can by any reasonably conceivable means find its way into the enemy's possession. Eternal vigilance in ensuring that this prohibition is carried out to the letter is the next essential, in which case we are wielding one of the most powerful weapons that can possibly be brought to bear against the enemy, and one which must have a very prominent part in determining the outcome and the duration of the present struggle.

So much for the present situation—but what about the future? Canada controls, according to present knowledge, the richest nickel mines in the world. We also have in almost unlimited measure, resources of both coal and iron. Canada thus possesses all, and controls one, of the three essential elements in the production of highest quality steel—a product which, it is probably safe to say, is more universally essential throughout the entire civilized world of commerce today than any other single item.

Should not our government be taking steps, therefore, to ensure the utilization of this valuable mineral within our own borders? The export of nickel at the present, or at any future date, except in its final and most valuable form, should be made as difficult as possible. To this end refining plants should be established either by encouraging private capital to enter the field, or under government management, and every possible encouragement should be given to our iron and steel industries already established and to others that may be induced to enter this field in the future.

The time to foster these industries is not when the war is over and our commercial competitors are again in a position to concentrate their activities on rebuilding their shattered trade—but **now**. Every day the matter is delayed is a day lost, an advantage gained by the enemy. "In times of war prepare for peace" should be the slogan of industrial Canada from the present moment. Let us so govern ourselves that, when the inevitable day of trade revival shall have dawned, our competitors will find we are already well prepared and have made a good start towards the goal of industrial supremacy.

## Buy Electric Christmas Gifts

We ask the special attention of electrical jobbers, dealers and central station managers to our article in the Dealer and Contractor section, treating of electrical appliances suitable for Christmas gifts. We do not lay claim to any particular originality in thus bringing this matter to your attention, but we do feel that the electrical Christmas trade has been carried on in years past less vigorously than it ought to have been in some cases, and entirely ignored in others. There is no doubt of its profitability both at the time of the sale and afterwards. Neither is there any doubt that in urging the purchase of electrical goods we are offering excellent value for money received. It seems almost as if some dealers and central station men themselves were not yet convinced of the wonderful value of electrical equipments. If there are a few such isolated cases, we can only hope that they will, in the near future, make a few tests



in their own homes. Up to the time of going to press with this issue, we have never heard of a single case of an electrical device being discarded which had once been given a fair chance of establishing its value and place in any household.

Electrical equipment in the home has, of course, been greatly boosted during the last year or two, but the remarkable fact about the whole matter is that all the statements are justified by results, and have even proven to be underestimates. As electrical men, then, let us continue to boost electrical household equipment, if not for what it is actually worth, at least for as nearly what it is worth as a limited vocabulary will allow us.

### No Change of Program

The Committee of Management of the International Engineering Congress have issued a pamphlet denying the report recently circulated to the effect that this congress was to be abandoned. The congress will be held in San Francisco, as scheduled, from September 20th to 25th, 1915.

In view of the conditions now prevailing in Europe, the governing bodies of the five National Societies under whose auspices the Congress is to be held, have recently given careful consideration to the feasibility of holding the Congress and to the probability of its success, with the result that each body has unanimously confirmed its original pledge to support the Congress. The Committee of Management is actively proceeding with arrangements, which are now well advanced, for meetings on the scheduled dates and for the publication of the transactions.

The Committee of Management is in receipt of a sufficient number of communications from various foreign countries throughout the world, including those located within the war zone, to indicate that a large majority of the papers originally requested for presentation at the sessions of the Congress and publication in its transactions will be handed in on time, and that the Congress will be truly international in character.

A detailed circular of information regarding the publications of the Congress has been prepared by the Committee and will be sent upon application to the Secretary, in the Foxcroft Building, San Francisco, California.

### Adding to Their Library

The Toronto Branch of the Canadian Society of Civil Engineers since last January have added to their library a considerable number of valuable series of Transactions, Proceedings, Journals and Reports, and, as well, some eighty engineering treatises and text-books. It is the intention of the Library Committee to have a printed catalogue of the whole library prepared and distributed in the near future, but, in order to encourage the immediate use of the library, this bulletin is issued. For the sake of brevity, only the more important series of publications are mentioned specifically.

Those desiring to consult the library will find at the headquarters of the Branch, 90-96 King Street west, a complete card catalogue according to authors and subjects covering not only the books, periodicals and reports belonging to the branch, but the libraries of the Engineers' Club, Ontario Association of Architects and Association of Ontario Land Surveyors. To all of these libraries members of the branch have access.

The eighty books added to the library comprise the most recent works on bridge engineering, cement and concrete, ceramics, chemical engineering, electrical engineering, foundations, heating and ventilating, highway engineering, hydraulics, mechanical engineering, metallurgy, railway engi-

neering, sanitary engineering, steam engineering, structural engineering and water supply.

The usefulness of the periodic literature in the Library has been considerably increased by the addition of the Engineering Index from 1906 to 1913.

The thanks of the Society are due the following firms and individuals for gifts of books and publications:

To the American Water Works Association for its Proceedings for 1902-1913.

To the Canadian Westinghouse Company (per Mr. W. M. Andrew) for a bound set of the Electric Journal.

To the Electrical News for 36 volumes on Electrical Engineering subjects.

To the Institution of Electrical Engineers (per Mr. Lawford Grant) for a set of its Journals for 1904-1914.

To the Boving Company of Canada and to Messrs. Edmund Burke, W. F. Ferrier, Arthur Hewitt, A. B. Lambe, A. L. Mudge, C. H. Mitchell, H. G. Nicholls, G. G. Powell and Norman Rankin for miscellaneous books, journals and reports.

In order to further extend the usefulness of the Library, it has been decided to allow members of the Canadian Society of Civil Engineers, in any grade, to borrow single volumes for a period not exceeding seven days. A fine of two cents a day will be levied upon any one who fails to return a borrowed volume upon the due date, and the Committee reserves the right to withdraw borrower's privileges from any member failing to comply with the regulations of the Library.

Those wishing to avail themselves of the privileges offered will consult the Librarian, Mr. R. B. Wolsey, or one of his assistants.

### Conservation of Western Water-Powers

The water power branch of the Department of the Interior, Canada, J. B. Chaffies, superintendent, have ready for distribution a limited number of "Water Resources Paper No. 2," covering Bow River power and storage investigations by M. C. Hendry, B.A.Sc. The importance of this work is well set forth in the superintendent's introduction, which reads in part as follows:—

"Conservation of the waters of the Bow River is of the utmost moment for upon it directly depends the agricultural and industrial prosperity of a very large area of southern Alberta. Rising in the high and remote regions of the Rocky Mountains National Park, and, with its many tributaries, furnishing the most interesting and attractive feature of this world-famed scenic park, it emerges from the park only to be harnessed to supply energy for transmission many miles away to the City of Calgary for municipal purposes, street lighting, tramways, and for general commercial and industrial use. After furnishing this hydro-electric energy, the same waters have, by irrigation, converted thousands of acres of otherwise useless land into the most fertile and fruitful tracts within the Province.

"At 'first blush' it would appear that the two important uses of this water for irrigation, and for power, would result in serious conflict of interest. Fortunately the irrigation requirements occur during high water stages of the river, and storage on its upper waters would make it possible to conserve enough of the flood flow, not required for irrigation, to equalize the low flow during the winter months that may be necessary for power purposes. The present use and distribution, and the future conservation, of the water resources of the Bow River basin, constitute one of the most important problems before the Department of the Interior. In some of its phases this problem has already been solved, while in others it awaits solution, although a beginning has been made, and the lines of practicable progress have been fairly well marked out.

"Realizing the importance of the Bow River waters to



every phase of the development of the district through which it flows, and of the utmost necessity of having a practicable conservation scheme worked out and put into practice without delay, the Dominion Water Power Branch has made a thorough investigation of the water resources of the Bow River basin above Calgary. These investigations have been carried on to completion with all reasonable thoroughness and every possible despatch under the immediate direction of Mr. M. C. Hendry, B.A.Sc., who has acted throughout with the continuous advice and assistance of Mr. C. H. Mitchell of the Consulting Engineering firm of C. H. and P. H. Mitchell, Toronto. They have been surprisingly gratifying, showing that it is economically feasible to so regulate the flow of the Bow River, by means of storage works in its upper waters, as to warrant the development at six power sites of over 45,000 continuous 24-hour w.h.p., all within 50 miles of the City of Calgary. At the same time it has been shown, that the using of these waters for power purposes above Calgary need not conflict with the consumption of the same water below Calgary for irrigation purposes; rather would the regulation proposed for power purposes be a distinct advantage to the extension of existing irrigation systems to their ultimate capacity, and also insure in the future the instigation of additional irrigation projects."

### Edmonton Power Plans

Some weeks ago the City Council of Edmonton, Alta., intimated that they were open to receive offers for the supply of electric power in bulk quantities for a number of years. It was further decided that all offers received were to be referred to Mr. Willis Chipman, of the firm of Chipman and Power, Toronto. The date set for receiving these power propositions was September 1st. Five offers have been received as follows:—

Sanderson and Porter, of New York and San Francisco, who propose to develop power on the Moose River in British Columbia, 250 miles west of Edmonton on the G. T. P.

G. W. Farrell and Company, of Montreal, who propose three plants on the Saskatchewan river, the first one at Rocky Rapids, 60 miles west of Edmonton.

The Wabamun Coal and Power Company, who propose to generate power from coal at their mine, 40 miles west of Edmonton.

S. W. Candy, capitalist, of Edmonton, offers to form a company and take over the present power plant and sell power to the city at a greatly reduced rate as compared with what it is costing the city to produce power now.

H. W. Adcock, of Winnipeg, who controls the water rights at Grand Rapids on the Athabasca, asked for an extension of time in which to submit his proposal.

### Hamilton Branch Elects Officers

The annual meeting of the Hamilton Electric Light & Power Company Section of the C. E. A. was held at their meeting room, Terminal Station, on Thursday evening, October 15th. The following officers were elected:—Hon. president, W. C. Hawkins; Hon. vice-president, E. P. Coleman; President, W. A. Sweet; Vice-president, Charles H. Fry; Secretary-treasurer, Leo V. Blatz. Executive committee,—Mr. Walter Kelly, W. E. Goring, Geo. D. Fearman, J. C. Smith. Property man, Chas. H. Fry.

Mr. Dorland, the retiring president, commented briefly on what had been accomplished during the past season. Mr. G. H. Goring, retiring secretary, also gave a complete report on the general affairs of the Section. A hearty vote of thanks was tendered to the retiring officers, as follows:—

President, W. D. Dorland; Vice-President, Mr. Geo. D.

Fearman; Secretary-Treasurer, Geo. H. Goring; Executive, L. W. Pratt, Chas. H. Fry, Hugh Lennox and W. G. Angus.

### Financial Standing for Nine Months

A statement has just been given out by Sir Adam Beck with reference to the financial standing of the municipalities, served through the Hydro-electric Power Commission of Ontario with Niagara power, covering the first nine months of the year. Certain of the municipalities, owing to adjustments yet to be made, are not reported, but from the figures given there is a surplus shown in every case. The figures follow:

Municipality	Gross Surplus	Net Surplus
Ottawa ... ..	\$28,144.05	\$ 1,673.65
Hamilton ... ..	28,213.73	12,213.73
London ... ..	48,289.16	27,067.16
Berlin ... ..	15,391.24	6,519.24
St. Thomas ... ..	19,344.64	14,025.64
Guelph ... ..	19,174.18	11,469.18
Stratford ... ..	9,813.58	5,739.58
Galt ... ..	15,325.64	8,380.64
Woodstock ... ..	8,891.41	4,877.41
Collingwood ... ..	4,009.12	2,026.12
Barrie ... ..	4,442.94	2,095.94
Ingersoll ... ..	5,797.41	3,210.00
Waterloo ... ..	5,366.58	2,750.58
Dundas ... ..	3,928.77	2,028.77
Preston ... ..	4,631.94	2,181.94
Penetang ... ..	1,632.04	183.04
St. Marys ... ..	4,369.64	1,919.64
Brampton ... ..	4,097.69	1,847.69
Tillsonburg ... ..	2,408.07	1,026.07
Weston ... ..	2,845.92	1,795.92
Milton ... ..	5,332.78	4,582.78
Mitchell ... ..	1,954.17	1,054.17
Elmira (10 months) ... ..	1,070.60	507.60
Norwich ... ..	1,214.05	800.80
Georgetown ... ..	1,923.24	1,332.24
N. Hamburg ... ..	2,564.15	1,889.15
Acton ... ..	546.90	181.99
Stayner ... ..	175.27	87.23
Hagersville ... ..	591.59	277.59
Baden ... ..	1,128.00	913.00
Caledonia ... ..	427.03	202.03
Coldwater ... ..	801.02	501.02
Pt. Stanley ... ..	2,122.04	1,645.24
Elmvale ... ..	457.83	202.83
Waterdown ... ..	689.33	384.83
Rockwood ... ..	821.34	611.34
Beachville ... ..	1,877.90	1,577.90
Port Credit ... ..	1,123.33	728.53
Thamesford ... ..	414.95	295.95

The Westbury Electric Light & Power Company, Cookshire, Que., have completed their transmission line to Robinson Bury, a distance of ten miles, and have had the lights at this point in operation since September 21st. The streets of the two villages known as Upper and Lower Town are now well lighted and about 700 domestic lights have also been installed. The meter rate is 8c. per kw.h., with an exclusive franchise for a ten-year term. Mr. H. A. Worby is president and general manager of the Westbury plant.

"Your directors have the same implicit faith in the future growth and prosperity of the country that they had from the beginning."—Sir Thomas Shaughnessy, president Canadian Pacific Railway Company, in his address to the shareholders at their annual meeting.



# Lump Sum Contracts for Power

By H. E. M. Kensit, M. A. I. E. E.

Comparatively little attention appears to have been so far given by power companies to the subject of lump sum contracts for power, that is, supplying all the power a customer requires under defined conditions for a fixed sum per annum.

Yet there are in certain cases considerable possibilities and advantages for the power company in this form of contract, and but little risk if the conditions are first properly investigated and the contract drawn with suitable safeguards.

The following remarks, founded on actual cases in which the writer has been interested, are offered as suggestive to power station managers who have not hitherto given any special consideration to this particular form of contract.

It is a fact only too well known to all electrical men that nearly all users of mechanical power over-estimate the power they produce and under-estimate the cost of producing it.

Still, for the sake of developing the argument which follows, it is necessary to go over some old ground and take a simple illustration of a typical case.

A factory working nine hours a day six days a week is operated by a 200 i.h.p. engine. The owner says the engine was indicated by the engine driver some time ago at full load on the factory and showed over 190 h.p., say 165 B.h.p. on the shafting. He therefore figures 54 hours by 52 weeks by 165 h.p. as equal to 464,000 h.p. hours per annum, which would be equivalent to 346,000 kw.h.

After much pressing he figures his cost of producing power and finds it about as follows:—

Fuel (6 lbs. per i.h.p. hour at \$4) . . . . .	\$6,400
Oil, stores, water, etc. . . . .	450
Wages . . . . .	2,000
Repairs and Maintenance . . . . .	600
	<hr/>
	\$9,450

or \$57.20 per brake horse power year.

## No Interest or Depreciation

He declines to consider any addition for interest and depreciation, as, from his point of view, the investment is made and would be lost if he substituted other power, or for management, insurance, etc., as this would be practically the same in any case.

If the proposal is to supply him per kw.h., he figures the cost on the above basis as equivalent to 2.7 cents.

He now expects the power company to offer him power at rates sufficiently below \$57.20 per h.p. year or 2.7 cents per kw.h. to make it worth his while to displace the engine and install motors, and he does not seriously consider the matter until the power company does so.

Maybe the power company can and does, but these are not the real facts as to costs and there may be a better way leaving more margin to the power company.

The real facts would be about as follows: By holidays and interruptions for repairs the factory will lose about five per cent. of the above calculated time and the average load will probably prove to be under three-quarters of full load, so that the energy actually used will be only seventy per cent. of 346,000 kw.h. or 242,000 kw.h. per annum. The factory costs are therefore at least 3.9 cents instead of the 2.7 cents the owner calculated.

But by the substitution of electric motors with their higher average efficiency, elimination of shafting and gear, facility for working any part of the plant separately, increase of output from steadier driving at the same rated speed, etc., there will be a further saving of 25 to 50 per cent. in the energy used. At 25 per cent. the actual energy used would be reduced to about 181,500 kw.h. per annum

and this figure represents approximately the actual amount that the power company would be called upon to supply to do the same amount of work as was done by the steam engine.

The object of the above so far is to show that by the substitution of electric power the consumer will usually make a large saving in the h.p. hours used for a given output. Not realizing this he expects a big reduction in the cost per h.p. year and he generally succeeds in getting both; the transaction is one for mutual advantage and the contention is that the power user usually gets more than his just share. None of the increased profit due to the saving in h.p. hours used goes to the power company, yet this is in many cases so large that the manufacturer could afford to actually pay the power company a higher price than it cost him to produce power himself and yet realize a profit on the transaction.

The question under discussion is whether the power company cannot get a larger share of the profit from the economies introduced and yet have a thoroughly satisfied customer.

As shown above the customer would figure his cost at 2.7 cents per kw.h. and he would probably not consider the inconvenience and expense of changing his arrangements unless power was offered to him at 2 cents or less. This is not a very attractive figure to a power company for an ordinary load overlapping on the peak.

## Quote Him Lump Sum

Suppose the power company wished to obtain 3 cents per kw.h. The actual consumption after equipment for electric driving would probably be, as shown above, about 181,500 kw.h. per annum, which at 3 cents would amount to \$5,445. We will suppose, for the sake of the argument, that this amount was quoted to the manufacturer as a fixed sum per annum for power to drive his factory while producing a given output.

Assume that with re-arrangement and sub-division of driving the customer would require 350 h.p. of motors between 10 and 50 h.p. each to replace his 200 h.p. engine. These would cost about \$3,900 and, with an additional 25 per cent. for installation, etc., say \$4,900, without allowing for value of plant replaced and sold.

As shown above the manufacturer's costs for fuel, stores, wages and repairs were \$9,450 per annum. His annual bill for power will now be about \$5,450, and, with 10 per cent. on his new investment of \$4,900, for attendance, oil and repairs, a total of say \$5,950 for power per annum. The difference of \$3,500 represents the annual saving secured by an investment of \$4,900 and which would therefore pay for itself in less than two years.

This fixed and guaranteed saving would be a strong enough inducement for almost any "prospect," and at the same time the power company is obtaining 50 per cent. more than it otherwise would, i.e., 3 instead of 2 cents.

Any electrical engineer can, of course, adapt the above figures to suit any case he meets, and the margin may often prove to be considerably greater. In a case within the personal knowledge of the writer, the "prospect" declined to consider an offer of 2.25 cents per kw.h., and the company, after investigation, offered a lump sum contract which was accepted. This showed a handsome saving to the power user and after two years he was still well pleased with his bargain, while the result to the power company is only a shade under 5 cents per kw.h. The power company, of course, do not disclose the kw.h. used.

It now remains to consider under what circumstances such a contract is possible. It is obviously not possible in such cases as woodworking or engineering shops, where the opportunities to waste power are unlimited and where there is no relation between power used and output of the factory. It is possible in such cases as grain, cotton and woollen



mills, boot factories and many other manufactures where a relation can be fixed between the output of the factory and the power consumed.

The power company must first satisfy itself by actual tests over a sufficient period as to the amount of power consumed and by examination of the books and records of the factory as to the output of goods during the same period, and it must ascertain the cost of power to the factory under the existing arrangements. The latter would, of course, be ascertained on the ground of figuring whether the power company's rates would offer any saving and before the proposal for a lump sum supply was made. The company is then in a position to name a lump sum price that will offer a sufficiently great inducement to the manufacturer and at the same time leave the company a satisfactory margin of profit.

Such a lump sum price would be for the supply of power to produce a given annual output from the mill, the price to vary pro rata with the output and the output to be certified annually by a statement audited by chartered accountants, or other satisfactory means. The approximate bills would be rendered monthly or quarterly with an annual settlement on the audited statement of output of the mill.

Such a contract, entered into after proper investigation and with a carefully drawn agreement is a reasonable business deal and would offer considerable advantages to both power company and consumer. The consumer would pay more but he would receive the benefit of knowing in advance what his costs would be and what his saving would be, before he incurred expenditure for new equipment.

### **The Relations of the Contractor to the Several Branches of the Electrical Industry—Address of President John R. Galloway, before the recent Jovian Convention at St. Louis**

The subject assigned me is so broad and comprehensive that to do it full justice would require vastly more time and thought than we can bring to its consideration today. Consequently I shall be brief and touch upon such points as I feel will best apply to the subject, leaving my thoughts with you for your consideration, feeling that you will separate the chaff from the wheat, and trusting you may find in them some seed worth sowing from which you may reap a harvest of some result.

In order to consider this proposition intelligently, it is necessary that we be frank with ourselves; let us come out into the open and wave aside every suggestion that is based upon superstition. We are not here to deal with the subject theoretically by promising ourselves impossible results. Let us submit the proposition to the radium of analysis and discover, if possible, the relations of the contractor to the several branches of the electrical industry.

The time was when every man did business for himself, worked by himself, regarded everyone else in the same line of business as undesirable citizens, and thought his splendid isolation was the only way in which to conduct business. Competition was limited and largely confined to "Have you got the goods," rather than "What is your price?" In those days personal equation in business counted for more than now. Under such circumstances, neither the individual industry nor the community progresses very rapidly.

But the wheels of progress roll on, destroying the old methods, crushing out ignorance, and man is often obliged to give way before them, as the old machines are thrown aside for the new. Education, as the pioneer, must step over human graves, over buried ambitions and lost opportunities. The law of progress is infallible, even if in our short-sightedness we call it cruel. The electrical industry though young, is making great progress, which is only the

forerunner of undiscovered wonders, that will make the old things of the past seem like toys thrown away, as childhood steps into manliness through growth, strength and perfection, which in itself is weakness.

With this condition of progress comes the manufacturer who creates each in himself a limited line of commodities, too limited for economical distribution to the retailer and consumer. Then comes the jobber, who stocks the various lines from the many manufacturers; the retailer, and the contractor, who draw from such assembled stock. And from necessity all electrical installations require much of the various kinds of electrical materials manufactured. The contractor, therefore, must have knowledge of, and be familiar with, all the various lines of electrical materials. He must be especially fitted and skilled as to how to properly assemble and install all these various lines of electrical material. It is the contractor who is best suited to point out to the manufacturer the necessity for new devices and changes in the old ones for a better and more perfect installation. And by reason of the contractor's special training toward the proper assembling and installing of electrical material, he becomes a creature of creation, because, after he has completed an installation for lighting or power, he has created a consumer of current, a consumer of additional electrical materials. So by reason of his special training and fitness and the touch of his skillful hands he has been of good assistance to the manufacturer, the jobber, and to the power station. So, by the analysis we find that several branches of the electrical development and the increased production of all lines of electrical materials, and the increase in the use and consumption of current, has been largely through the influence and skill of the contractor. This is beyond question a recognized fact, and I have the courage to say that we contractors have long since been important factors in the development of several branches of the electrical industries; we are proud in our belief in holding that position today, and we stand ready to lend our assistance and best efforts to the end, that the development of several branches of the electrical industries must go on. To do this brings us to the point of co-operation, so we organize and assemble, and mutualize our interests by association and co-operation. We concentrate the individual effort in the direction of a general distribution of responsibility to the end of practical benefits.

Practical commercial interchange in the "Electrical Industry" is no longer a theory—it is a fact. The teachings of the Jovian Order are being accepted as a foundation upon which a strong, stable, betterment of everything electrical can be accomplished. Standing as I do before you today, associated with you as I am, I am impressed with the purpose of your organization, with the earnest and honest efforts of the individuals who are units that in their assembling create what I deem to be the greatest association in the history of modern times. I feel the demand made upon us as poor mortals to bring together under the banner of harmonious association the unit of thought, of desire, of purpose, to the end that the consummation of our hopes may at no late day find emblazoned in letters of gold upon the scroll of effort in the service of humanity the one word, "Success."

I want to see the Jovian Order continue to prosper, because its prosperity means more ideal electrical trade conditions. An organization such as the Jovians, has, therefore, many functions and opportunities for good; it represents the various interests of the electrical industry, and it can be successful only so far as it recognizes the equal rights and privileges of every department of the great industry which it represents. So then the manufacturer, the jobber, the retailer, the central stations and the contractor, all of these various interests are conserved, inasmuch as the success of one is dependent upon the success of the other. They are simply spokes in the wheel of progress.



# High Tension Transmission Troubles

## Valuable Data on Transmission Practices Collected from the Experiences of a Large Number of Companies

The High-tension Transmission Committee of the American Institute of Electrical Engineers some time ago sent out a printed list of questions to some 105 power companies operating at 25,000 volts and over. This data has now been analyzed and tabulated by the data sub-committee, and was presented in report form at the recent annual convention of the institute. Much of the matter was sent in in the form of comment, and as such does not lend itself to tabulation. A number of these comments are reproduced herewith. It is believed that the comparison of experience and practice set forth in these remarks cannot fail to be of much value to the engineering profession and should certainly be of great assistance to those engineers who may have high-tension lines to establish in the near future, and who have not at their disposal the time and opportunity for the extended research necessary in the construction of plants of highest efficiency.

### List of Operating Companies

#### 100,000 Volt Group

Mississippi River Power Company (M.R.P.), Keokuk—recently completed.

Great Western Power Company (G.W.P.), California—operating several years.

Yadkin River Power Company (Y.R.P.), North Carolina—recently finished.

Pacific Gas & Electric Company (P.G. & E.), Central California—operating several years.

Chile Exploration Company (C.E.), Chile—not yet operating.

#### 85,000 Volt Group

Mexican Light & Power Company (M.L. & P.), Mexico—operating several years.

Appalachian Power Company (A.P.), West Virginia—operating short time.

Southern Sierras Power Company (S.S.P.), South Carolina—operating some years.

Pennsylvania Water & Power Company (P.W. & P.), Baltimore.

#### 60,000 Volt Group

Washington Water Power Company (W.W.P.), Washington.

Toronto Power Company (T.P.), Toronto.

St. Joaquin Light & Power Corporation (S.J.L. & P.), California.

Niagara, Lockport & Ontario Power Company (N.L. & O.P.), New York.

Portland Railway, Light & Power Company (P.R.L. & P.), Oregon.

Southern California Edison Company (S.C.E.), California.

Chippewa Valley Railway, Light & Power Company (C.V.R.L. & P.), Wisconsin.

Western States Gas & Electric Company (W.S.G. & E.), California—wood pole construction.

Puget Sound Traction, Light & Power Company (P.S.T.L. & P.), Washington.

City of Seattle Lighting Department (S.L.D.).

#### 50,000 to 25,000 Volt Group

Utah Light & Railway Company (U.L. & R.), Utah.

Canadian Niagara Power Company (C.N.P.), Niagara Falls.

Mount Whitney Power & Electric Company (W.P. & E.), California.

Union Traction Company (U.T.), Indiana.

### Long Spans

The following notes of interest were returned:

M.R.P.—Longest span with standard tower and conductor 1,425 ft. The maximum span used on this line is 3,200 feet, and occurs at the crossing of the Missouri River. The conductor cable consists of a  $\frac{5}{8}$ -in. high-strength galvanized 19 strand steel core overlaid with 20 strands of No. 10 B. & S. gauge hard drawn copper wire. The cable is filled with a compound for the exclusion of air and moisture. Each circuit is carried on a single tower line, conductors in a horizontal plane, spaced 20 ft. apart, with two ground wires 10 ft. above at point of support. These river crossing towers were especially designed and vary in height from 60 to 230 ft. above foundations.

G.W.P.—One span 2,300 ft. on special towers; one 2,740 ft. with No. 000 B. & S. "Minot" stranded wire; conductor balanced by counterweights to give uniform tension.

M.L. & P.—One 1,400 ft. with a difference in elevation of 350 ft.; cable size and towers standard.

P.W. & P.—Longest span with standard conductors and towers 1,280 ft. Longest span 1,800 ft. with No. 0000 B. & S., 7 strand hard drawn copper and towers 115 ft. high over all above foundations. Span sag 120 ft. (6.7 per cent.). Distance between conductors, vertically 10 ft., horizontally 15 ft.—Ground wires above conductors—no trouble.

S.L.D.—Longest span 780 ft. standard double-pole construction.

W.W.P.—One 1,500 ft.,  $\frac{1}{4}$ -in. "Siemens-Martin" steel as conductor.

S.J.L. & P.—Span across Kings River at Piedra, six 3/0 aluminum cables, carried about 1,700 ft. across river and anchored on hillsides to cedar poles. Two sets of three wires each are attached to two poles, wires in a vertical plane six ft. apart and attached to poles with two Locke No. 273 strain insulators. Guys are placed for each wire and run to anchorage in rocks. About 200 ft. sag is obtained with wires clearing river about 150 ft. All wires swing in unison in a high wind and no trouble has been experienced.

C. N. P.—The transmission line crosses the Niagara River at Buffalo where there is a span of 2,192 ft., from a 150-ft. tower on the American side to a 202-ft. tower on the Canadian shore. The tops of these towers are at the same elevation. The line is then carried over the village of Fort Erie with a span of 1,667 ft. to a 61-ft. tower on Bertie Hill. The top of this tower is 107 ft. below that of the High tower. The minimum clearance of the cables above the river is 130 ft. On the high towers the cables are arranged on 15-ft. triangles and on the Bertie Hill tower on 10-ft. triangles. The twelve conductor-cables are made up of 19 strands of No. 10 B. & S. gauge bi-metallic wire and are stressed up to 5,400 lbs. This tension is kept constant by counterweights on the Buffalo and Bertie Hill towers. The counterweights are supported by steel cables which run over sheaves at the top of the towers and are connected to each bi-metallic cable through two pairs of spool insulators. Drop cables pass down and through the tower to the Buffalo terminal station and on the Bertie Hill tower to the bus-bars. The bus-bars and switches are so arranged that any circuit on the pole lines can be connected to any circuit on the long spans. At the



high tower, the cables are connected to galvanized iron chains which rest on insulated saddles and extend about 13 ft. on each side of the tower. Jumper cables are carried over the saddles.

In addition, spans of 800 and 1435 ft. were reported by other companies and no cases of trouble.

### Special Features of Construction

The following notes relate to special features of interest in construction:

A. P.—All suspension insulators are ballasted with 30-lb. cast iron weights.

P. R. L. & P.—Experience has shown that it is cheaper and quicker to erect steel towers in position from the ground up.

### Anchor Towers on Tangents

The following reports were made on the use of anchor towers on tangents:

M. P.—Approximately every mile.

G. W. P.—Average every two miles; designed to stand with all wires cut.

A. P.—Two per mile, designed to stand with all wires cut.

S. S. P.—Every five miles, designed for 24,000 lbs.

P. W. P.—At least every fifth tower; on average five to mile.

S. J. L. & P.—Poles guyed both ways every half mile; will stand with three conductors cut.

N. L. & O. P.—Every mile on steel towers; every half mile on "A" frames; all to stand with all three conductors cut.

S. C. E.—No, use line guys.

U. L. & P.—Every  $1\frac{1}{2}$  to 3 miles, according to wind conditions; designed to stand 7,000 lbs. at centre crossarm in addition to stress on regular line towers.

C. N. P.—Only at two ends of line and two intermediate curves; designed to stand all conductors cut.

### Deterioration

The following notes on deterioration were received:

G. W. P.—Slight rusting where towers were not properly galvanized; wires corrode.

Y. R. P.—Line two years old; no deterioration noticed.

P. W. & P.—No deterioration observed upon examination of buried portions of galvanized towers. One particular set of gusset plates near top of tower showing signs of rust during 1913; no rust or deterioration elsewhere. No signs of deterioration in conductors. Insulators both on transmission line and in stores showing deterioration, due possibly to temperature expansion effects. About 4 per cent. of insulators examined to show such deterioration; not due to electrical causes.

W. W. P.—We have noted no deterioration in conductors. Some insulators placed in service in 1904-1906 indicate that they may have deteriorated, but as the manufacture of porcelain at that time was far less efficient than now, no results of long time tests on those would indicate what will obtain on the ones of later manufacture. Towers were placed in 1910, and no deterioration has been noticed.

T. P.—Except for some deterioration of ground wire and hemp core of conductor, no deterioration noticed.

S. J. L. & P.—No deterioration noticed as yet; 60,000-volt system in use only three years.

N. L. & O. P.—Galvanized towers develop rust spots in about seven years. Insulators to some extent deteriorate by puncture of an occasional skirt. No noticeable deterioration of cable except by occasional burning by arcs.

P. R. L. & P.—The transmission line has been in service less than two years and we have, therefore, no observations of deterioration except in the matter of insulators, there having been a considerable number of failures in suspension

insulators and insulators in a strain position since the line was put in service.

S. C. E.—Insulator shells crack, presumably due to expansion of cement or steel pin.

C. V. R. L. & P.—Insulators give more trouble with age.

U. L. & R.—Wood poles with carbonized butts last 10 years in this climate.

P. S. T. L. & P.—None, if proper factors of safety were observed in original installations. Steel towers have to be painted every two years, if not galvanized. Cedar poles rot off at the ground in from 15 to 20 years.

S. L. Dpt.—Poles rot at ground line.

### Deflection of Suspension Insulators

As to how much angular deflection of conductor was assumed under wind conditions and how much was actually observed, the following data were reported:

M. P.—26 deg. 45 min., with  $\frac{1}{2}$ -in. ice, assumed.

G. W. P.—45 deg. assumed.

Y. R. P.—45 deg. assumed.

A. P.—30 deg. on swinging of strings; held down by 50-lb. weights.

S. S. P.—45 deg. assumed; 45 deg. observed on swings.

P. W. & P.—Approximately 60 deg.; probably never more than 30 deg. angular deflection from vertical due to wind observed under either steady wind conditions or swings. No good records on actual angular deflection. Conductors do not swing violently, and angular deflection is not the same at all points in a span for one conductor, but is the same for all conductors.

W. W. P.—50 deg. assumed; 36 deg. observed.

U. L. & P.—60 deg. from vertical assumed, this value observed in swings.

### Design Factors of Safety

As to the factors of safety provided in conductors, towers, against overturning foundations, and overhead ground wires, the following data were reported:

M. P.—Conductors 2, towers 3, foundations 2, ground wires 2.

G. W. P.—Conductors 2, towers 2, foundations 3, ground wires 3.

Y. R. P.—Conductors 25,000 lbs. per sq. in.

M. L. & P.—Conductors 2 and 3, foundations 1.5.

A. P.—Conductors 2, 3, towers 2, foundations 5, ground wires 10.

S. S. P.—Conductors 2.5, towers 1.7, foundations 1.7.

P. W. P.—For conductors (alum.) up to elastic limit; towers tested for maximum designed strength at factory; foundations practically 4; ground wire just up to elastic limit.

W. W. P.—For conductors elastic limit, for towers 1, for foundations 1, for ground wire 1. These factors are taken in view of the fact that the maximum load conditions assumed were very severe.

S. J. L. & P.—For conductors 6, for poles 3.

N. L. & O. P.—For conductors 1 (elastic limit), towers 2, foundations 2.

S. C. E.—For conductors 22,000 lbs. per sq. in. working stress.

S. L. D.—Factor for conductors of 3 over elastic limit.

### Overhead Ground Wires as Part of Structure

In answer to the question as to whether overhead ground wires are relied upon as part of the line structure most of the companies replied no, but the following comments were received.

Y. R. P.—Yes.

P. W. P.—Ground wire gives some stiffness lengthwise of line, damping longitudinal vibrations of towers, but is not relied on as part of the mechanical supporting structure.

U. L. & P.—No, but it undoubtedly acts as a guy wire.



### Cutting Out of Load

A loaded circuit is usually cut off by an oil switch, sometimes on high tension, sometimes on low tension. The following replies are noted:

G. W. P.—Drop generator load and open generator oil switch on low-tension side. Do not switch on high-tension side.

Y. R. P.—(a) Reduce voltage 60 per cent. and then open low-tension oil switch. (b) Open low-tension oil switch at full voltage. (c) Open high-tension oil switch at full voltage.

M. L. & P.—Cut out sections of line one at a time loaded or unloaded. Experience shows that this method gives less trouble from surges on oil switches and switch bushings.

### Opening Short Circuit

To open a short circuit that holds on, the following companies reduce the voltage of the generators:

M. P.; G. W. P.; S. C. E.; C. N. P.

Note also the following comments:

S. S. P.—The hydro-electric plants are tied in by non-automatic switches on the low-tension side while the steam plant has oil breakers with definite time circuit relays on the low-tension side. The high-tension switches in the main tower line are of the Bowie air-break type and are non-automatic. As operated at present, when short circuit occurs on tower line, the steam plant breakers clear the southern end of the system of trouble, leaving the steam station with all load in that territory. The hydro-electric plants then drop voltage to low value and test for location of trouble.

S. C. E.—Separate main system into sections and cut out step up transformers on high-tension side.

### Automatic Overload Relays

Automatic overload relays are generally used, and in many parts of the various systems. The majority are definite time limit or inverse time limit. The overload settings run from 100 per cent. to 300 per cent. overload, and the definite time limits from  $\frac{1}{2}$  to 10 sec. A half dozen companies use overload relays of progressively greater time element distributed from the load to the generator.

M. P.—Use inverse time limit automatic overload breaker to cut apart groups of generators on the 11,000-volt generator busbars.

N. L. & O. P. and S. C. E. report success with this selective action; Y. R. P., M. L. & P., and W. W. P. report partial success.

P. W. & P.—Automatic overload circuit breakers are used in connection with 13,000-volt cable feeders, station auxiliary transformers at both power house and sub-station, and transmission lines; in the last case, however, not the high-tension circuit breakers, but the low-tension circuit breakers of those transformers connected with the line being opened. In connection with 13,000-volt cable feeders, we use inverse-time relays; for the transformers and transmission line, definite-time-relays.

(a) The lowest tripping current for the relays connected with our 13,000-volt cable feeders is 100 per cent. overload, based on cable rating; with 700-1,400 per cent. overload these relays will trip in 1 sec. (inverse time).

(b) The relays for the sub-station transformers are reverse-power relays set to trip at 50 per cent. overload in reverse direction, and connected with a three-sec. definite element.

(c) The power house transformer relays trip at 140 per cent. overload 7 sec. definite time.

Time-element relays are normally used with progressive timing of the elements. This refers particularly to the relay system used for the 13,000-volt a.c. underground cable system in Baltimore, of which a part belongs to the P. W. & P. Co., and a part to our customers' distributing systems. The larger part of the relays for this system are Type C Westinghouse

overload inverse-time relays improved by F. E. Rickett's compensating coil, which produces a relay curve with less steep characteristic and for heavy overloads can be brought to approach a definite time. Both tests and experience have shown that this type of relay can give good selective action for several relays in series. Bellows type relays were previously used in this connection but were found to be not sufficiently reliable and were replaced by relays of the type referred to above. Westinghouse Type C, improved, reverse-power relays with selective element are also used. These reverse-power relays are used at the sub-station end of two transmission lines working in parallel. When a short circuit, which is not cleared in any other way, occurs on one line, it will trip the low-tension side of transformers at the sub-station connected with this line, while overload or time relays will trip the low-tension side of the corresponding transformers at the power house. If the other transmission line is not affected, the reverse-power relays for this line will remain open. In order to give another device (arc extinguishers) time to relieve lightning arcs, these relays for the transmission lines are furnished with definite time-limit relays (W. Type E); these have at present the following setting:

	Circ. No. 1	Circ. No. 2
Power House . . . . .	3 sec.	$2\frac{1}{2}$ sec.
Substation . . . . .	$1\frac{1}{2}$ sec.	1 sec.

The different time setting for the two circuits is chosen in order to prevent one line from opening at the sub-station, while the other opened at the power house, in case both lines should be in trouble. As soon as one circuit is cleared, an interlocking device prevents the other from opening by any relay action. If after the clearing of one of the two parallel transmission lines, the other still shows the trouble the field will momentarily be taken off all the generators at the power house simultaneously, and restored again. Should this action not clear the second line, the switches must be opened by hand. Our experience so far shows, however, that permanent line trouble (wires down, etc.) never has taken place on both circuits at the same time.

P. S. T. L. & P.—Success generally but not always.

Aside from the P. W. & P., the U. P. & R. and P. S. T. L. & P. are the only companies using reverse-energy relays; the former reported "always" act selectively—the latter does not state the result.

S. I. D.—Use Westinghouse Type C, reverse-energy relays which act selectively when the power factor does not drop too low as on a very heavy short circuit.

### Dropping Synchronous Load

The following report that they seldom or never succeed in carrying synchronous load through a heavy main-line short circuit:

G. W. P.; M. L. & P.; S. S. P.; T. P.; S. J. L. & P.; P. R. L. & P.; W. S. G. & E.; C. N. P.; U. T.; S. L. D.

Other reports—

A. P.—Sometimes. Lightning arcs are frequently cleared by arc suppressors without losing synchronous load.

P. W. & P.—Lightning arcs are frequently cleared without the least loss of load, by arc suppressors.

W. W. P.—We have automatic switches on all lines feeding out of the different stations and when these act properly we very seldom lose any synchronous load.

N. L. & O. P.—Save synchronous load by automatic arc extinguishers, when arcs only are involved.

U. L. & P.—Yes, when short circuit is cleared in three seconds.

P. S. T. L. & P.—Sometimes we can and sometimes we cannot. If the duration of short circuit is three or four seconds synchronous apparatus always drops out.

### Cutting Out One of Two Parallel Lines

In answer to the question as to when two lines parallel



at both ends could be cut out without losing the load the following were received:

M. P.—Two St. Louis lines parallel at both ends and have been separated in a number of cases automatically without losing the load.

M. L. & P.—Four lines are operated in parallel and as a rule one line can be cut out without losing the load.

A. P.—Sometimes.

W. W. P.—Have such lines but cannot cut them out without losing load.

S. J. L. & P.—Lines are tied together at load end by tie-breaker set light; at supply end lines are separated by operator.

N. L. & O. P.—Have tried this but have abandoned the attempt.

P. R. L. & P.—Yes, but cannot be automatically separated.

S. C. E.—All main lines, cannot separate.

C. N. P.—Cannot separate such lines.

U. T.—Cannot separate such lines.

### Locating Trouble

Practically all plants sectionalize the line, test with generator voltage and patrol to locate line trouble.

Y. R. P.—Use also a Wheatstone bridge method.

N. L. & O. P.—Use a special loop test described in the Trans. A. I. E. E., June 1907.

C. N. P.—Uses a loop test.

### Effect of Heavy Short Circuit

As to the effect of a heavy short circuit near one power station on a large system:

P. W. & P.—When a short circuit occurs near one power house, the effect of this depends entirely on how long a time it lasts.

(1) If it is a lightning arc on the transmission line it will normally be cleared by arc suppressor.

(2) If it is cable trouble on the 13,000-volt distributing system, it will normally be cleared by opening automatically the proper feeder switches. If the trouble hangs on for more than four seconds the fields of the generators will be destroyed and restored automatically at all three power houses simultaneously.

### Operation With One Side Grounded

In answer to a question as to whether the lines were ever operated with one side grounded, even for a brief period, the following were received:

P. W. & P.—For a few minutes, no effect; ground was cut off by the time the ground resistance was red hot.

U. L. & R.—All one night on 28,000-volt circuit; no effect except unbalancing of system.

C. N. P.—For about two hours with no effect except a slight unbalancing of current in conductors.

A. P.—For two hours with no effect.

W. W. P.—For several minutes causing whole system to be unbalanced.

G. W. P.—For about ½ hour; one oil switch bushing and one string of insulators punctured.

S. S. P.—No; effect too severe.

T. P.—On several occasions for five to fifteen minutes, on one occasion four hours. On the occasion when the system was operated for four hours the ends of the cable that were down were 1,000 ft. apart, the ground was highly charged and the barbed wire on the right-of-way fence was also highly charged. A man attracted by the display due to this ground walked into the charged area, then tried to climb the barbed wire fence and was killed. A dog approached the barbed wire fence some distance away and after investigation started for remote regions. Claims were made for damages to cattle. These were paid, although it could not be

found that any cattle were really injured. In operating on a ground we have no means of knowing whether or not the wires are down, and as it is possible that there may be two grounds miles apart with an open circuit in the conductor between, we consider it a very risky thing to continue such operation and would only do so as a last resort.

S. J. L. & P.—For two and a half hours on 60,000 volts; for one and one-third hours on 30,000 volts. The effect was unbalanced voltage on the particular feeder having a ground; unbalanced load on nearest generating plant, private telephone line out of commission, troubles reported from Sunset and other telephone systems.

N. L. & O. P.—On one occasion when neutral was not grounded, for two hours; effect "violent."

P. S. T. L. & P.—For 10 minutes; severe strains, discharging lightning arresters; telephone wires hot.

### Relays in H.-T. Ground Connection

No plant of those reporting except P. W. & P (see below) seems to have any protective relay in the ground connection from the high-tension neutral, except for the fuse of the Nicholson arc suppressor.

### Voltage Regulators

The use of Tirrill regulators to control the voltage of generators is almost universal and there appears to be no exception to the satisfaction they give.

### Failure of Oil Switches

As to whether oil switches have ever failed to open a circuit, most companies report no trouble, but the following are noteworthy:

M. L. & P.—Very rarely.

S. S. P.—No, but signs of distress are often shown. Most of the trouble from oil switches occurs in the breakdown of bushings from lightning or surges.

T. P.—H-3 oil switches have failed repeatedly when more than four 100,000 kw. generators can feed through them to a short circuit.

N. L. & O. P.—Yes, from repeated operation on short circuit without overhauling.

U. L. & R.—4,000-volt, three-phase oil switch on overload.

S. C. E.—On short circuits; the system has outgrown the size of the switch.

P. S. T. L. & P.—Oil switches which are type H-3 and K-10 have always opened short circuits successfully but sometimes the switches are nearly wrecked.

### Working With Adjacent Line Alive

Practically all companies except S. L. D. work on one of two lines on the same poles or towers when the other line is alive.

### Which Insulator of Suspension String Fails First

As to which insulator unit in a string of units is most likely to be injured, note the following:

G. W. P.—Insulator next to line, but in general it is hard to tell.

P. W. P.—Flashovers damage first and last units preferably.

W. W. P.—Nearly always the first and last of the string.

P. R. & L.—No difference.

U. L. & R.—End disks.

### Relative Reliability of Suspension and Strain Insulator Strings

There is a difference in experience as to whether strain insulators are more likely to fail than vertical strings. P. R. & L.; U. L. & R.; P. W. P.; W. W. P., and Y. R. P. say "no." G. W. P. and S. C. E. say "yes."



# Electric Railways

## Developments in Electric Traction\*

By W. B. Potter

The electrification of railways has naturally been extended in the classes of traffic where the substitution of electric power has afforded advantages not obtainable with power of some other character. Electric motor cars, as compared with the horse or cable car, were immediately recognized as a more efficient method of transportation, and the extraordinary development of the trolley car service was a natural result.

During the early development of electric equipment for transportation purposes the individual car and the electric locomotive received about equal attention. Because of the greater opportunities in urban service the motor car soon became more prominent, and for a number of years the motor car equipment received almost exclusive attention.

Results obtained in trolley car service demonstrated beyond question the success of electric power and did much to establish confidence in the reliability of electrical equipment. For the heavier service of handling trains the use of a motor car as an electric locomotive was but a natural development. The entrance of electric power into the domain of the steam locomotive really began in the early nineties with small trains in passenger service. The Intra Mural Railway at Chicago in 1893, where motor cars were used as electric locomotives, initiated in this country the permanent invasion of the extensive steam service on elevated lines.

The further development of multiple unit control, permitting any number of motor cars in a train to operate in unison, made possible a schedule performance which even the largest of steam locomotives would be incapable of handling, quite apart from the objectionable features incident to the use of steam.

The earlier applications of electric power to regular steam railway service were in most cases for service in tunnels and railway terminals, with the object of eliminating the smoke and gases common to the use of steam locomotives. The Baltimore & Ohio Tunnel which commenced operation in 1895 was the first instance of electrification as applied to heavy traffic, and the first electric locomotives to successfully initiate the struggle for supremacy with steam locomotives under main line requirements.

### Only Question—Will it Pay?

The electrification of main line service is no longer an experiment. The heaviest traffic can be successfully handled, and therefore there remains only the question of whether it will pay. As a rule, excepting the expense incident to the initial investment, the cost of operation with electric power will be less than with steam, and often this saving will show a handsome return on the investment. There are many instances, such as tunnels and terminals where other considerations than the financial showing are of paramount importance. Even in such instances there are often local conditions where the value of property will be enhanced, or where

territory necessary to steam service can be made available for other purposes and therefore remunerative.

The possibility of handling heavier, or even equal trains at higher speeds is becoming better recognized as a means of increasing the tonnage over a given route, and so provide for an increasing traffic more economically than by the construction of additional lines under steam operation.

Electric locomotives for heavy traffic must be so constructed as to withstand the service shocks and strains which occur in the handling of trains, and to facilitate inspection and maintenance the electrical and other equipment should be conveniently located. Much attention has been given to the development of different general types, and many varieties of electric locomotives differing both in mechanical design and electrical equipment have been built and tested.

Variations in the mechanical construction are influenced largely by different methods of transmitting the power from the electric motor to the driving wheels. The motor car and steam locomotive have both served as models with innumerable variations in which their characteristics have been differently combined and in many cases with indifferent success. Geared or gearless motors mounted on the driving axle, or in special cases a combination of gearing and parallel rods, each with reference to its fitness for the particular purpose, are the most promising methods of drive. Guiding trucks will undoubtedly be used in high speed service and doubtless at slower speeds with very heavy locomotives where the weight distribution on the track may be of importance.

### Relative Merits of A.C. and D.C.

The character of electrical equipment, considering the larger power required in main line service is influenced by the problem of electric transmission to the locomotive and the collection of current from the conduction circuit. As the amount of current varies inversely as the voltage, the transmission and collection are therefore made easier at higher potentials. The development of equipment suitable for higher voltages has received much attention, and there are at present a number of important railway electrifications of this character on which alternating or direct current is used. The respective merits of alternating or direct current involve many details of which only a few are of general interest as influencing the trend of commercial development.

The equipment for alternating current, whether three-phase, single-phase or split phase, does not at present appear susceptible of many improvements by which the cost may be reduced, and there is further an uncertain investment for counteracting the influence of the alternating current on telegraph and telephone lines.

Direct current operation at potentials higher than 600 volts is no longer in the experimental class; the most important electrification being the Butte, Anaconda & Pacific, where successful operation at 2400 volts has been fully demonstrated.

A vital question affecting the use of direct current in heavy service is the amount of current which can be successfully collected from the conducting circuit, particularly



from an overhead construction, as with the third rail there is ample margin even at 600 volts.

As a device for collecting current the ordinary trolley wheel has proven successful in handling far heavier equipment than originally contemplated. The roller pantograph, which is in effect an elongated trolley wheel, has proven very successful in service for which the ordinary trolley wheel would not be suitable. The sliding pantographs, of which there are many in service, when fitted with copper faces have a collecting capacity even exceeding that of the roller, and there is no doubt a pantograph equipped with a suitable sliding collector will successfully collect current to the full capacity of the overhead conductor.

An improvement in the overhead cantenary construction, accomplishing the double purpose of securing greater flexibility and an increased conductivity, is obtained by the use of two conductors lying close together in the same plane, with the supporting hangers located alternately so that the mid-span of each conductor is opposite the supporting hanger of the other. Within practical limits 1,000 amperes may easily be collected from a single 0000 conductor and 2000 amperes from two 0000 conductors. With a copper conductor and copper faced sliding collector having grease lubrication, the tests and obtainable records indicate a life of the conducting wire fully comparable with that commonly obtained with a trolley wheel or roller pantograph.

#### Indications Favor Direct Current

It is a reasonable statement that with a potential not exceeding 3,000 volts, no difficulty will be experienced in collecting from an overhead construction the current required by locomotives in the heaviest passenger or freight service. The choice of a higher direct current voltage is, therefore, a question of economics—whether the saving in copper or further spacing of sub-stations will justify the greater cost of rolling stock equipment at a higher voltage. Careful estimates, comparing 3,000 volts with higher voltages up to 6,000 as applied to main line operation, show practically no advantage in favor of the higher voltage. In the majority of cases in this class of service the investment for locomotives is by far the larger item as affecting the selection of the voltage.

As between the different systems the indications point strongly toward the more general adoption of direct current for main line electrification and heavy railway service generally.

## The Electric Railway and the Farmer

By John R. Graham\*

The extension of the electric railway into the rural districts has contributed in a greater degree to the advancement of farming in communities remote from markets than any other development of modern times. The electric railway has brought the markets to the farmer's door, making it possible to load his produce on cars without leaving his premises and at the lowest possible expense for handling and haulage. Butter, cream, milk and garden truck can be delivered fresh to the markets each morning within two hours by express service, enabling the farmer to compete successfully with the city gardener. In many cases small sawmills have been built along the line with convenient loading facilities, permitting the farmer to manufacture his lumber and market it where, previous to the coming of the electric railway, this lumber had little value.

Social conditions on the farm have been immensely improved as a result of the electric railway. The farmer's family is no longer isolated from its neighbors and the city, and the problem of how to keep the children on the farm should no longer be a serious one in the communities thus

served. Thanks to the electric railway, the farmer can enjoy the advantages of the city, the schools, churches and the theatre, while his wife and daughters can take advantage of the bargain day sales in the city stores. With the electric railway has also come the electric light, and village streets once dark and gloomy after sunset are now brightly illuminated. Manual labor on the farm is being replaced with electrically-operated devices, and this wonderful development will result in bringing more people back to the farm.

The electric railway is a genuine help to the farmer if its work is carried out along broad lines, without legal restrictions against encouraging the progress of the agriculturist. To aid in developing agriculture along its lines the Bangor Railway & Electric Company has established a demonstration farm of 120 acres on the line running from Bangor to Charlestown. This farm is under the supervision of the University of Maine, to demonstrate the possibilities of intensive production of potatoes, corn, oats and other crops. A strict account is being kept of the amounts of each crop raised and the phosphates used, along with the cost of labor and any other expenses associated with raising this produce. It is hoped to produce 400 bushels of potatoes per acre when the farm is in full operation, compared with the usual 200 bushels which represents the average output of the farmers in the State of Maine.

#### Ten Fold Freight Increases

In order to encourage the raising of potatoes in the Kenduskeag Valley, the Bangor Railway & Electric Company in 1908 reduced the electric freight rates one-half on carload lots of potatoes. In that year sixty-seven carloads were shipped. The business has increased greatly each year, and in 1913 more than 600 carloads were shipped. During the present season it is anticipated that more than 750 carloads will be handled by the line, representing an increase of more than 1100 per cent. in six years, and on a line only 25 miles long, with a population of but 2500 people. The freight and express over this line totals more than 50 per cent. of that handled on all the other electric railways in Maine. What has been done on this line can be duplicated elsewhere. The opportunities are attractive for the farmer in stock-raising, but to do this successfully there must be good fencing. The farms of Maine present a decided and unfavorable contrast to those of Canada in this particular. Stock raising will help to keep the young men on the farm, and besides improving the fertility of the land it will stimulate additional traffic on the electric railways running through such communities. I would like to buy 500 head of yearling Hereford cattle in the West and distribute them to farmers along the lines of the Bangor company, but at present we have no fences good enough to hold them.

#### Value of Centralized Management

The prosperity of public utilities closely affects the communities served by them. Farmers sometimes do not appreciate any more than other people the benefits of a centralized management of public utilities. These may be brought home to them in a practical and common-sense way, without undue self-praise. In 1902, for example, the various properties centering at Bangor were five or six in number. Their bonds were selling at about 50 per cent. below par and their stocks were at the lowest ebb financially. None of these corporations paid dividends. All have now been consolidated into the Bangor Railway & Electric Company and are in a prosperous condition through economical and financial operation under centralized management. Where the Maine savings banks and investors used to buy out-state securities, they are now gradually absorbing the stock of our public service corporations. One of the trust companies in Bangor has sold securities to the amount of more than \$3,000,000 to investors in our locality. There is a good demand for Maine

\* Electric Railway Journal.



public utility securities, and there are great possibilities in water-power development, which should be encouraged by low taxes and liberal laws. The different companies in which I am interested in Maine are today using more than 30,000 h.p. hydro-electrically generated, whereas ten years ago there were only 3,000 h.p. of hydro-electric development in these systems. All of this benefits the farmer as well as the city resident in our territory, and through broadened services, possible production of fertilizer by the utilization of atmospheric nitrogen, application of power from the railway and lighting transmission lines to farming machinery, electric cooking and other developments, the outlook for the future is very attractive. As a device for taking up what might be called economic lost motion between the city and the country, the electric railway managed along the lines above outlined has no superior.

### Code of Principles—Adopted by the American Railway Association at their Recent Convention

I.—The first obligation of public utilities engaged in transportation is service to the public. The first essential of service is safety. Quality of service must primarily depend upon the money received in fares. For this reason it is necessary that the rate of fare should be sufficient to permit the companies to meet the reasonable demands of patrons and to yield a fair return on a fair capitalization.

II.—Regulated private ownership and operation of electric railways is more conducive to good service and the public welfare than government ownership and operation because the latter are incompatible with administrative initiative, economy and efficiency, and with the proper development of cities through the extension of transportation lines. The interests of the public are fully protected by the authority given to regulatory bodies.

III.—In the interest of the public and good service local transportation should be a monopoly and should be subject to regulation and protection by the state rather than by local authorities.

IV.—Short-term franchises are detrimental to civic welfare and growth because they ultimately check the extension of facilities and discourage good service.

V.—In order to render good service, electric railways must be allowed to earn a fair return on a fair capitalization, and the foundation for this result will be obtained if the issuance and sale of securities representing such fair capitalization shall be legally authorized on such terms as will produce the requisite funds.

VI.—Securities which have been issued in accordance with the law as it has been interpreted in the past should be valid obligations on which an electric railway is entitled to a fair return.

VII.—The relation of adequate wages to efficient operation should always be recognized, but electric railways, being public servants regulated by public authorities, should be protected against excessive demands of labor and strikes.

VIII.—The principle of ownership of securities of local companies by centralized holding companies is economically sound for the reason that the securities of the latter have protection against the varying business conditions of a single locality or company and because money for construction and improvements can thus be more readily obtained.

IX.—In the appraisal of an electric railway for the purpose of determining reasonable rates, all methods of valuation should have due consideration.

X.—Full and frank publicity should be the policy of all transportation companies, to the end that proper information may be available to the investor and the public.

### Company Rights Protected

Canadian holders of Mexican securities will be interested in the further assurance of the Carranza government that their seizure of the property of the Mexican Tramways Company was merely with a view to continuing present operations, and until such time as negotiations between the company and the striking employees could be brought to a successful issue. We understand the proceeds of operations are being handed over to the company regularly.

### Special Church Service

The Winnipeg Electric Railway Company have inaugurated a special church service. This will mean that twenty extra street cars will be placed at the disposal of church goers at the time when they are most needed.

### Electric Railway Donation

Patriotic Day on Welland street cars resulted in a donation of \$220 to the Patriotic Fund. The ladies of the town handled the boxes during the day with the result that fares were anywhere from \$5 down.

It is suggested that an application be made to the Ontario Railway and Municipal Board for an order compelling the Toronto Railway Company to provide five cent fares to city workmen on night duty. It is difficult to see, however, how the board can make such an order, as the amount of the fare constitutes a part of the company's franchise agreement.

### New Books

**Fifth Annual Report**—Issued by the Commission of Conservation of Canada, covering the operations of the commission for the fiscal year ending March 31st, 1914, and containing a report of the proceedings of the fifth annual meeting held in Ottawa, January 20 and 21, 1914.

**Electric Light Fitting**—by S. C. Batstone, A.M.I.E.E., Whittaker & Company, London and New York, publishers; price, 5s. net. This is a treatise on wiring for lighting, heating and other domestic uses to which electricity may be applied. Includes also information covering the lay-out of typical small private installations. It has been the writer's chief aim to adhere entirely to the practical side of the matter.

**Polyphase Currents**—by Alfred Still, M.I.E.E., M.A.I.E.E., etc.; Whittaker & Company, London and New York, publishers. Price 6s. net. Revised edition. A book treating of the theoretical considerations involved in polyphase working in such a manner as to commend itself to practical engineers and students without the mathematical knowledge required for the study of advanced works on this subject. The assumption is made that the reader has a fair knowledge of continuous currents, but is unfamiliar with alternating currents. Three hundred pages, well illustrated.

**Principles and Practice of Electrical Engineering**—by Alexander Gray, Whit.Sch., B.Sc., assistant professor of electrical engineering, McGill University. McGraw-Hill Book Company, publishers; price, \$3.00 net. This work is based on a lecture and laboratory course delivered to the senior civil, mechanical and mining students at McGill University, and is suited for men who desire to obtain a broad idea of the principles and practice of electrical engineering with only a limited amount of time at their disposal. The book gives a self-contained lecture and laboratory course, much of which is suitable for private reading. The illustrations are excellent throughout and especially in the chapter on alternators, where the different phases are distinguished in colors.



# Illumination

## Illumination of Public Buildings—No Excuse for Poor Lighting—Engineering Information for the Asking

Little by little the value of modern illuminants, supplemented by proper glassware, is coming to be appreciated, both in private and public buildings. That the process of education is somewhat slower than the developments in the art, is scarcely to be wondered at, for the public is not accustomed to such progress as has been made in the last two or three years in illuminating engineering, and so is apt to listen with incredulity to the enthusiastic illumination solicitor who points out the excellence of his wares, and to class him among the authors of fairy tales of the past ages. Seeing is still believing, however, and as the number of modern installations increases, the number of people who fail to see them and so go unconvinced is rapidly decreasing. In the present article, we show a couple of examples of recent adjustments of the lighting equipment in two of Toronto's public buildings. One of these, St. Anne's Church, represents a class of building in which very noticeable developments are taking place all over Canada at the present time, the idea having taken firm hold apparently that good light, restful to

produce not only a sufficient intensity on the reading plane, but also to illuminate the general interior and bring out, to the best advantage, the beauty of the architecture, for which so many of our churches are becoming famous. Fig. 2 illustrates, to good advantage, the use of a semi-indirect system.



Fig. 2. As well lighted as your own home.

In this case the ceiling is of moderate height and, together with the walls, may be depended on to reflect a fair part of the light over their entire area. We lay special stress on the last words "entire area," because no semi-indirect system of lighting can be satisfactory or efficient if the conditions are such that a very large percentage of the ceiling at least cannot be utilized to redirect the light reflected up from the glass bowl.

To obtain proper lighting effects using the semi-indirect system, one must carefully analyze the conditions of the surrounding interior and co-relate with these the lighting units and reflectors that are to be used. Many efficient lighting units are rendered inefficient both from an illumination and an appearance standpoint because, for example, of improper suspension. Effectiveness and efficiency in semi-indirect lighting is dependent in a general way on four main factors: (a) position of outlet; (b) conditions of ceilings and walls; (c) distance of bowl from the ceiling, and, (d) last but not least, style, size and quality of the glassware.

Fig. 3 shows a simple but effective treatment of a beautiful deep acid etched and decorated semi-indirect bowl suitable for a residence. Fig. 4 is another semi-indirect bowl, plain but very efficient and specially adapted for the new nitrogen high efficiency lamp.

The glassware illustrated herewith represents a few typical examples of the products of the factory of the Jefferson Glass Company, Toronto, the only Canadian manufacturers of illuminating glassware. This company will upon request place their engineering department at the disposal of intending



Fig. 1. A restful interior.

the eye and mind alike is quite as important in a church as in a theatre or other public building. The interior of St. Anne's is shown in Fig. 1. Here we have a typical high ceiling interior, where proper and effective illumination can only be attained with diffused lighting directed in such a way as to



purchasers. There is, therefore, no excuse for anyone going it blind, who has an installation of any considerable size in charge. Illuminating engineering to-day as a science has reached a very high stage of development. It is still possible, however, to equip a private or public building with a lighting system which is both inefficient and inartistic. It is equally true that, without added cost, advice may be obtained from

### All-Nite-Lite Transformer

The All-Nite-Lite transformer, now being introduced by the Canadian General Electric Company, has been designed to meet the increasing demand for some more economical form of electric light for use in the all night illumination of such places as hospital-rooms, door-fronts, cellars, stairways, halls, bathrooms, telephone-booths, closets and other places where a small energy-consuming light is desired. The complete device consists of a miniature transformer contained in a polished brass shell, and a miniature mazda lamp. It operates on any alternating current supply circuit ranging in voltage from one hundred to one hundred and twenty-five, and on frequencies from fifty to one hundred and forty cycles. It is installed by simply screwing it into the standard lamp socket in place of the usual incandescent lamp. The

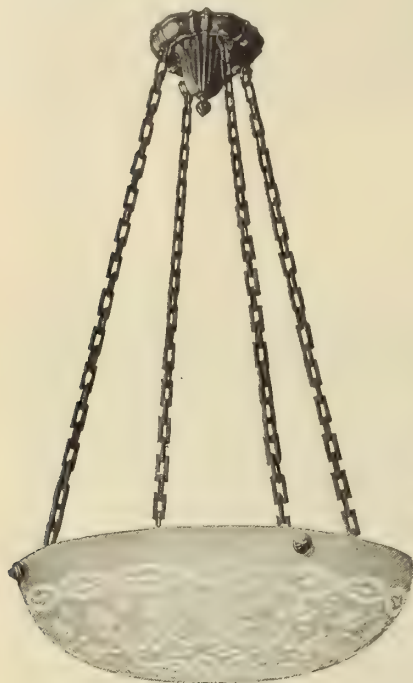


Fig. 3. A beautiful design.



Fig. 4. Very efficient.

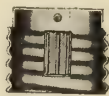
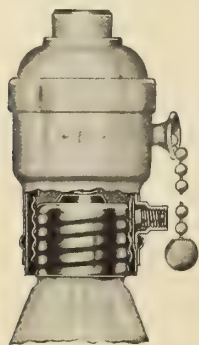


Low voltage, high efficiency night lamp.

reliable sources, which will add from 50 to 100 per cent. in both. That advice may be obtained either as in the present case without cost, or through consulting engineering firms who specialize in illumination. The main point, however, we wish to make in this matter is that reliable advice should be obtained from some source, that mistakes of the past with its unnecessary extravagances may not be repeated.

### A New Lock Socket

The accompanying illustrations represent a new lock socket just placed on the market by the Arrow Electric Company, Hartford, for which the Northern Electric Company are Canadian distributors. This device is known as the "Arrolock" socket. It prevents loss of lamps through theft and also prevents the use of high wattage lamps, heat-



Arrolock socket —  
Cannot steal or  
change the lamp.

ing devices and other current consumers where the use of such articles is not desired. The "Arrolock" is attached to any brass shell type Arrow E socket. The operating device is simple, a small set screw being turned in against a serrated, hardened steel clamping piece, which engages with the lamp base. A special key is used to operate the set screw.

transformer, although miniature in design, is constructed with liberally insulated primary and secondary coils, and with a core built of the highest grade of transformer steel punchings. Its function is to transform the normal supply voltage to about six or seven volts before it is supplied to the lamp. The receptacle for the lamp is designed to fit a rear and speedometer mazda automobile lamp, 2 c.p., 6 and 7 volts, 1.25 w.p.c., G-6 bulb with bayonet base. At the average cost of electricity, All-Nite-Lite transformer can be operated for ten hours at a total cost of less than four-tenths of a cent.

### Personal

**Mr. F. C. Carman**, well known to the electrical trade, has joined the sales staff of the Radiant Electric Company, Grimsby, Ont.

**Mr. J. Shields**, consulting electrical contractor, has been appointed city inspector of wiring installations by the Toronto Hydro-electric Commission.

**Mr. Charles H. Dudley**, formerly of the Toronto Hydro-electric System, has accepted the position of sales manager of the Volt Electric Company, Limited, Toronto.

**Mr. Joseph Showalter**, chief engineer salesman of the meter department of the Ferranti Electrical Company of Canada, Limited, Toronto, has been appointed to succeed Mr. J. G. Monahan as manager of this company's Winnipeg branch.

**Mr. Lawford Grant**, general sales manager of Eugene Phillips Electrical Works, Limited, Montreal, is now on a visit to England.

**Professor L. A. Herdt**, of McGill University, has just returned from a visit to England and the European Continent.

**Mr. J. H. Gunther**, for many years manager of the Bell Telephone Exchange at Listowel, has resigned and will enter private business.

**Mr. J. G. Jackson** is local manager of the hydro-electric system in Chatham.



# The Dealer and Contractor

## Electric Gifts Most Appropriate

For Christmas—Suitable for Friends in Any Circumstances or of Any Age—Fit Every Pocket

Supplementing our article of November 1st on electric toys for the Christmas trade, we are reproducing in the present issue, herewith, further suggestions and illustrations of the more useful class of electrical appliances. So great has been the attention paid in recent years by electrical manufacturers in general to this type of equipment, and so successful have they been in meeting the popular demand for articles that are both useful and luxurious, and at the same time efficient and economical, that the majority of electrical appliances now on the market must rather be classed as necessities than luxuries, and this indeed is the light in which actual users of these articles, those who have learned their value from personal experience, do nowadays look upon their electrical appliances.

The sale of electrical appliances for Christmas gifts has every reasonable argument in its favor. The prices of the articles are such as the majority of people can pay. The appropriateness for all classes, all ages and both sexes is unquestioned. Finally, as a constant pleasant reminder of the giver it has no equal, for each day the electrical appliance brings added pleasure and appreciation. The central station further gains by encouraging the purchase of electrical equipment as each purchase means increased current consumption and added revenue. Christmas is essentially a time of rejoicing and we believe there is no development of the past century that has added and will yet add so much to the capacity of the human being for real, solid, permanent enjoyment as the application of electricity in its various and varied forms to the one hundred and one labor-saving, pleasure-giving household appliances. For these reasons, we submit that jobbers and central stations should use every effort to make this the biggest electrical Christ-

mas yet, strong in the assurance that, while it is good business for themselves, they are also prosecuting a campaign that will have far-reaching effects in raising the standard of human knowledge and intelligence, and in increasing our capacity for work as well as pleasure.

A few brief descriptive comments referring to the articles illustrated on the following pages are given herewith,—

Figs. 1 to 6 inclusive represent a number of useful and efficient household appliances manufactured by the Northern Electric Company, Limited, Montreal. Fig. 1 is a curling iron heater, applicable to any size iron; Fig. 2, a very useful chafing dish. Fig. 3 represents a toaster stove with which

a meal can be prepared right on the dining table. Fig. 4 is a percolator which insures you a cup of best quality coffee in a minimum of time and at a minimum expenditure. The toaster shown in Fig. 5 makes two slices of bread at once into crisp, delicious toast. Fig. 6 represents the "American Beauty" iron, weighing 6½ lbs.

Figs. 7, 8, 9 and 10 show representative Canadian Westinghouse equipment. Fig. 7 indicates how easily and luxuriously a breakfast may be prepared on the dining table. Fig. 8 is an attractive looking and comfortable feeling three-glow heater. Fig. 9 is a utility motor, which may be used to operate grinders of various sorts, polishers, etc. Fig. 10 represents another form of toaster.

Fig. 11 illustrates one form of coffee percolator handled by the Canadian General Electric Company. The value of an electric percolator in the home can scarcely be over-estimated. The coffee begins to percolate in less than two minutes and a delicious cup of this stimulating beverage is ready for use in a minimum of time. Fig. 12 shows an attractive table lamp representing one of a very large number of designs handled by this company.

Fig. 13 represents the "Ideal" smoothing iron manufactured by the Ideal Electric Manufacturing Company, Wallaceburg, Ont. Note that this electric iron is pointed at



Getting nothing more than he deserves.—Who does not envy him?



both ends, thus facilitating the work and reducing the time spent on many such articles as shirt-waists, children's dresses, etc. These irons are guaranteed for ten years. This article is representative of a general variety of appliances manufactured by this company, including toasters, disc stoves, radiators, percolators, etc.

Fig. 14—Typical of the well-known products of the Canadian Hotpoint Electric Heating Company, to which the trade name El Perco, meaning excellent percolator, has been given.

Fig. 15—A flash light handled by the Canadian Carbon Company and equipped with their well-known "Nine Lives" battery.

Fig. 16—An instantaneous hot water heater handled by the Volt Electric Company, Toronto. This is an exceedingly useful gift, especially for the man friend who is often impatient at the length of time it takes to heat his shaving water in the morning.

Fig. 17—A small portable oven suitable for light house-keeping, manufactured by the Radiant Electric Company, Grimsby. It is typical of a number of various designs of stove manufactured by this company.

Fig. 18—The Tuec stationary vacuum cleaner, manufactured by J. J. Martindale, Toronto. Stationary cleaners are already being placed in all the new buildings of any considerable size and according to present indications will soon be considered essentials in every residence except those of very insignificant dimensions.

Fig. 19 represents the well-known 1900 washing machine, an efficient washer electrically operated. No Christmas present would be more appreciated by the thrifty housewife in these days of strict economy.

Fig. 20—A warming pad manufactured by the Radiant Electric Company, Grimsby. It is especially useful for elderly people, either during the day or after retiring. As a face warmer, back warmer or foot warmer it is entirely replacing, both in convenience and safety, the other forms of similar devices now on the market. Fig. 21 represents another product of the Radiant Electric Company—a water heater with self-contained unit. This type of appliance is one of the most efficient as well as one of the most useful on the market today.

Fig. 22 represents a small iron typical of a number of sizes handled by the Canadian General Electric Company.

Fig. 23—A small but efficient portable type cleaner, manufactured by the Duntley Products Company, of Erie, Pa.

Fig. 24 represents a small portable cleaner well known throughout the Dominion, that of the Onward Manufacturing Company, Berlin. The cost of operating this cleaner is about the same as to light one ordinary capacity lamp, and it does the work of cleaning easily and expeditiously.

Fig. 25 is a decorative type of portable lamp manufactured by the Canadian General Electric Company, Toronto.

Figs. 26 and 27 are further representative of the dining table equipment of the Canadian Westinghouse Company. Fig. 26 is a coffee percolator; Fig. 27, a tea samovar, both of them splendid examples of today's possibilities of luxurious living at a minimum cost.

Fig. 28—A small stove manufactured by the Hughes Electric Heating Company, Chicago. This company has made strenuous efforts to capture the trade of western and central Canada, and their measure of success speaks well for the quality of their ranges.

Fig. 29—A toy transformer manufactured by the Electric Manufacturing Company, Baltimore.

Fig. 30—Another form of range manufactured by the Hughes Electric Heating Company, Chicago.

Fig. 31 represents one form of a very efficient house warmer handled by the Masco Company. This warmer is so controlled that a graded heat may be obtained almost automatically. Fig. 32 represents another line handled by the

Masco Company, a massage vibrator. To the tired back or the haggard and worn face nothing has more invigorating effects than an electric vibrator. The cost of operation is negligible.

Fig. 33—Another utility manufactured by the Canadian General Electric Company—a chafing dish—one of the most universally appreciated pieces of household equipment on the market today.

Fig. 34—A door-bell transformer manufactured by the Electric Manufacturing Company of Baltimore.

Fig. 35—An electrically-operated night clock, handled by F. I. Spielmann, Montreal. This clock is suspended on a swivel and may be so adjusted and illuminated as to throw the image of the dial on the wall or ceiling or any point most convenient to the occupant of the room as he lies in bed. See also Fig. 64.

Figs. 36 and 37 are typical of the products handled by the Canadian Laco-Philips Company. Fig. 36 is their well-known projector lamp. Fig. 37 is a very efficient lamp for both night and day burning. By day this is a 35 watt 27 c.p. light, and by night a 5 watt 3 c.p. unit.

Fig. 38—One of the designs of tea samovar handled by the Canadian General Electric Company.

Fig. 39—Coffee percolator of the Simplex Electric Heating Company, Belleville.

Fig. 40—One of a variety of portable lamps carried in stock by F. I. Spielmann, Montreal.

Fig. 41—An electric comb for hair drying—handled by the Volt Electric Company, Toronto.

Fig. 42—One type of smoothing iron manufactured by the Simplex Electric Heating Company.

Fig. 43—The well-known "Seafoam" electric washer and wringer manufactured by Cummer-Dowswell Limited, Hamilton.

Fig. 44—A head-piece suitable for the amateur wireless telegraph operator. Manufactured by Holtzer-Cabot Electric Company, Brookline, Mass.

Fig. 45—A small size flash light manufactured by the Canadian Carbon Company. This flash light also is equipped with the well-known "Nine Lives" batteries.

Fig. 46—Another of the products of the Volt Electric Company—an efficient smoothing iron.

Fig. 47—One of a number of household appliances manufactured by the American Electrical Heater Company, of Detroit. The agency for this company is held by the Northern Electric Company, Limited, Montreal.

Fig. 48—A very useful article in the form of a universal drier, handled by R. E. T. Pringle, Toronto. This drier may be used for hair drying, face drying, shoe drying or any of the many other drying operations so common in the average home.

Fig. 49—Another form of coffee percolator, manufactured by the American Electrical Heater Company, Detroit. Fig. 50 is a rapid water heater by the same company.

Fig. 51—Another of the products handled by the Volt Electric Company—a rapid electric toaster.

Fig. 52—A hot plate manufactured by the Hughes Electric Heating Company, Chicago, Ill. Such a hot plate can be used for a very large and varied number of household operations, and as a Christmas present would be fully appreciated by anyone interested in the preparation of light meals.

Fig. 53—Another form of the Duntley portable vacuum cleaner of larger capacity than that shown in Fig. 23.

Fig. 54—Another type of coffee percolator manufactured by the American Electrical Heater Company, Detroit. Fig. 55—An electric iron showing in the background a Christmas box suitably decorated for Christmas giving.

Figs. 56 and 57 are illustrative of a very efficient toaster and radiator, named respectively El Tosto and El Radio,

(Continued on page 42)





Curling Iron Heater

Fig. 1—Curling iron heater—Northern Electric Company, Montreal.



Fig. 2—Chafing dish—Northern Electric Company, Montreal.

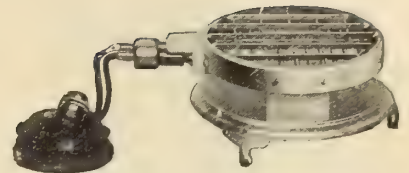


Fig. 3—Grill—Northern Electric Company, Montreal.

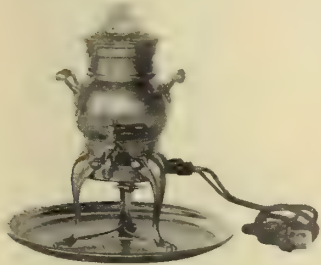


Fig. 4—Coffee percolator—Northern Electric Company, Montreal.

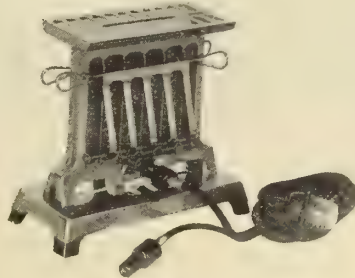
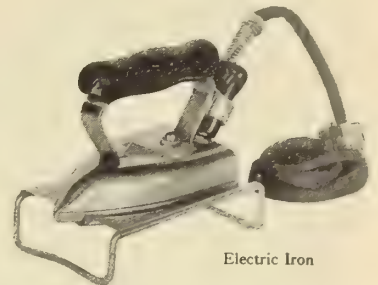


Fig. 5—Toaster—Northern Electric Company, Montreal.



Electric Iron

Fig. 6—Electric iron—Northern Electric Company, Montreal.



Fig. 7—The electric breakfast—Canadian Westinghouse Company, Hamilton.



Fig. 8—Luminous radiator—Canadian Westinghouse Company, Hamilton.

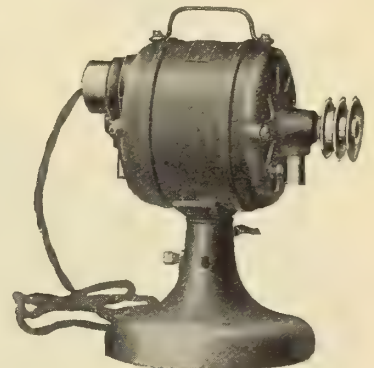


Fig. 9—Utility motor—Canadian Westinghouse Company, Hamilton.

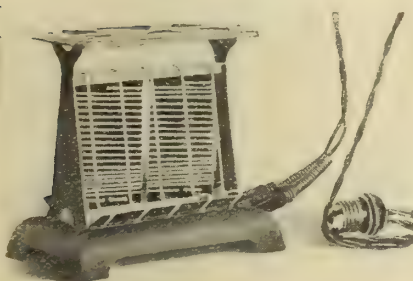


Fig. 10—Vertical toaster—Canadian Westinghouse Company, Hamilton.



Fig. 11—Coffee percolator—Canadian General Electric Company, Toronto.



Fig. 12—Table lamp—Canadian General Electric Company, Toronto.

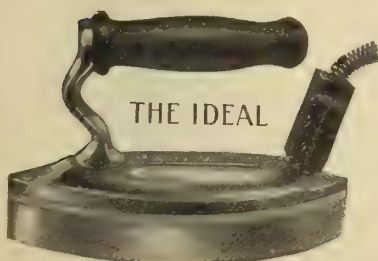


Fig. 13—Electric iron—Ideal Electric Manufacturing Company, Wallaceburg, Ont.

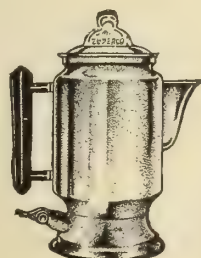


Fig. 14—Coffee percolator—Canadian Hotpoint Electric Heating Company, Toronto.

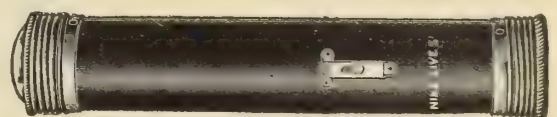


Fig. 15—“Nine lives” flashlight—Canadian Carbon Company, Toronto.



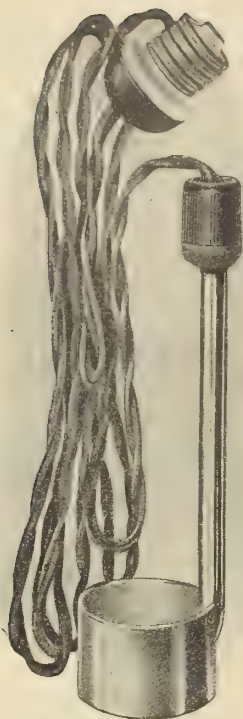


Fig. 16—Instantaneous Water Heater—  
Volt Electric Company, Toronto.

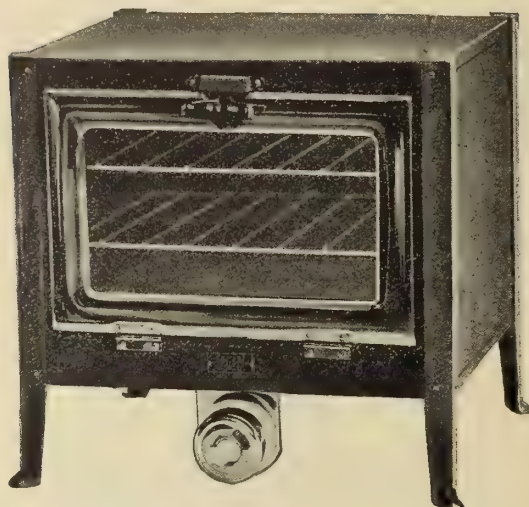


Fig. 17—Electric oven—Radiant Electric Company,  
Grimsby, Ont.

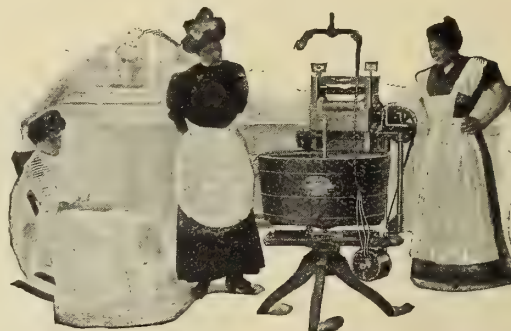


Fig. 19—Washing machine—1900 Washer Company,  
Toronto.



Fig. 20—Warming pad—Radiant Electric  
Company, Grimsby, Ont.



Fig. 21—Tea kettle—Radiant Electric Company, Grims-  
by, Ont.



Fig. 18—Stationary cleaner—  
United Electric Com-  
pany, Toronto.



Fig. 22—Smoothering iron—  
Canadian General Electric  
Company, Toronto.



Fig. 24—Portable cleaner—On-  
ward Manufacturing Company,  
Berlin, Ont.



Fig. 25—Portable table lamp—  
Canadian General Electric  
Company, Toronto.

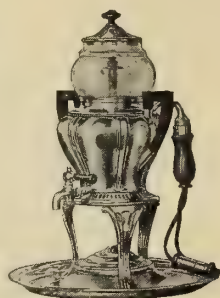


Fig. 26—Coffee percolator—  
Canadian Westinghouse  
Company, Hamilton.



Fig. 23—Portable cleaner—  
Duntley Products Com-  
pany, Erie, Pa.

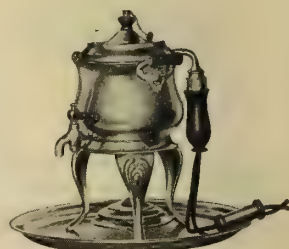


Fig. 27—Tea samovar—Can-  
adian Westinghouse Com-  
pany, Hamilton.





Fig. 28—Portable oven—Hughes Electric Heating Company, Chicago, Ill.

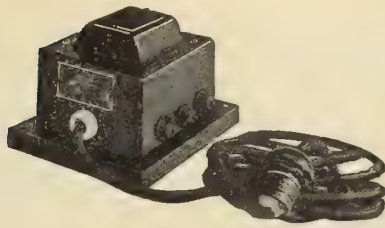


Fig. 29—Toy transformer—Electric Manufacturing Company, Baltimore, Md.

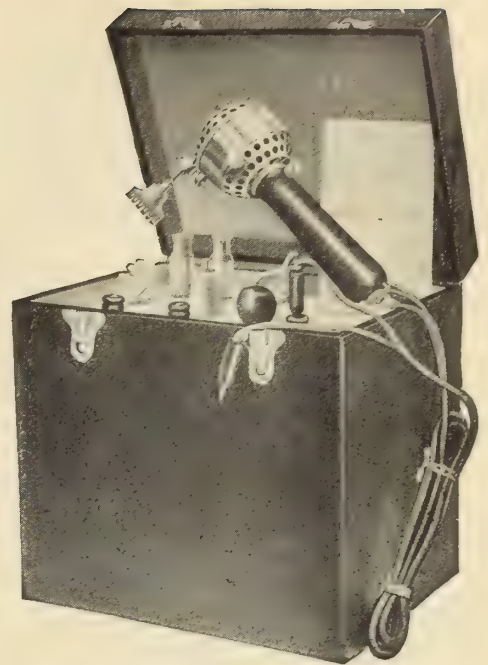


Fig. 32—Massage vibrator—The Masco Company, Toronto.

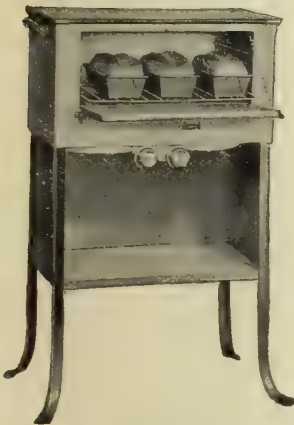


Fig. 30—Bake oven—Hughes Electric Heating Company, Chicago, Ill.

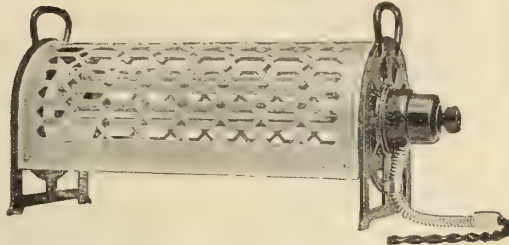


Fig. 31—Heater—The Masco Company, Toronto.

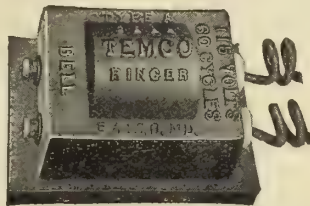


Fig. 34—Bell ringing transformer—Electric Manufacturing Company, Baltimore, Md.

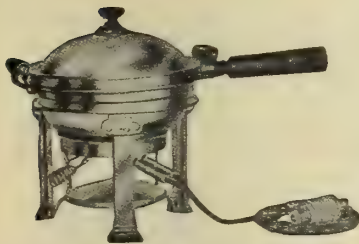


Fig. 33—Chafing dish—Canadian General Electric Company, Toronto.

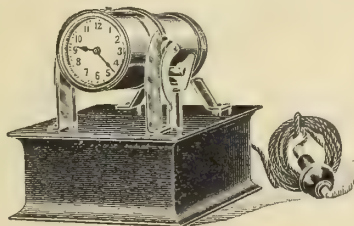


Fig. 35—Ceiling clock—F. I. Spielmann, Montreal.

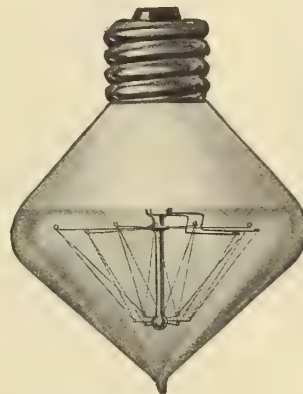


Fig. 36—Projector lamp—Canadian Laco-Philips Company, Toronto.



Fig. 37—Dimbrite—Canadian Laco-Philips Company, Toronto.



Fig. 38—Tea samovar—Canadian General Electric Company, Toronto.



Fig. 39—Coffee percolator—Simplex Electric Heating Company, Belleville, Ont.

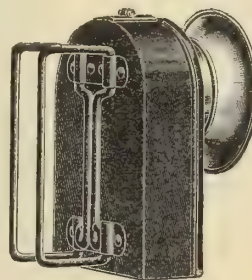


Fig. 40—Flash light—F. I. Spielmann, Montreal.

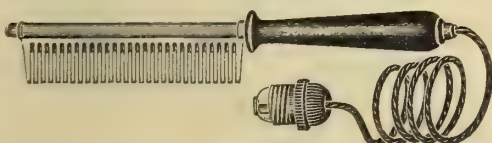


Fig. 41—Electric comb—Volt Electric Company, Toronto.



Fig. 42—Household iron—Simplex Electric Heating Company, Belleville, Ont.

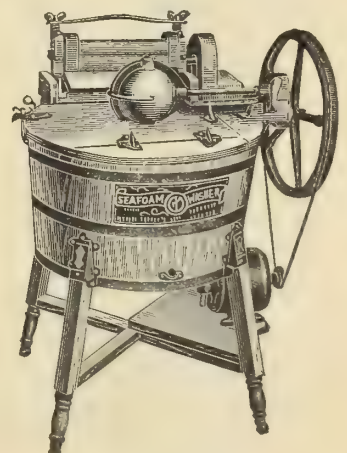


Fig. 43—Washing machine—Cummer-Dowdell Limited, Hamilton.



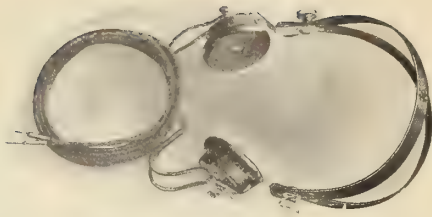


Fig. 44—Wireless receiver — Holtzer-Cabot Electric Company, Brookline, Mass.

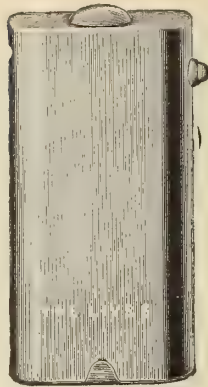


Fig. 45—Pocket flash light — Canadian Carbon Company, Toronto.



Fig. 46—Electric iron—Volt Electric Company, Toronto.

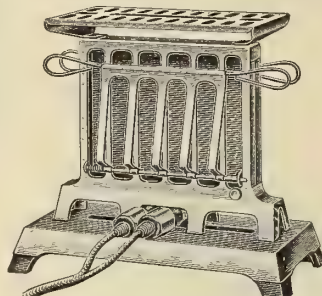


Fig. 47—Toaster — American Electrical Heater Company, Detroit, Mich.

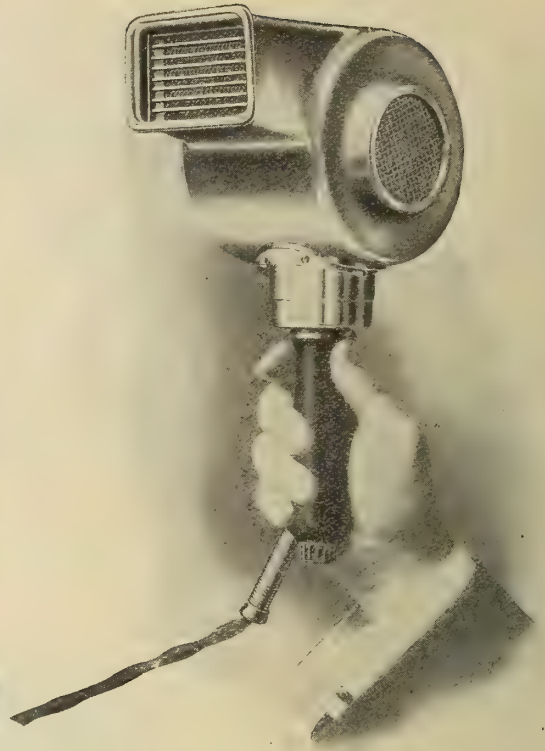


Fig. 48—Universal drier—R. E. T. Pringle, Toronto.



Fig. 49—Coffee percolator—American Electrical Heater Company, Detroit, Mich.

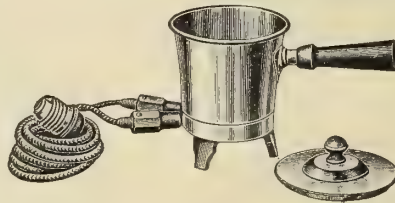


Fig. 50—Water heater — American Electrical Heater Company, Detroit, Mich.

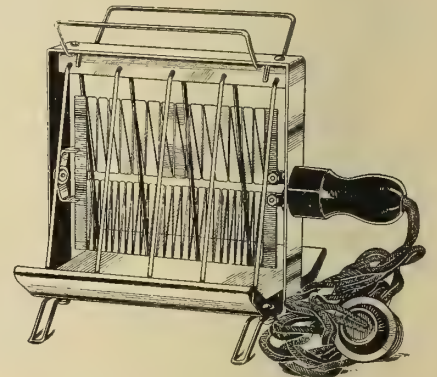


Fig. 51—Toaster—Volt Electric Company, Toronto.

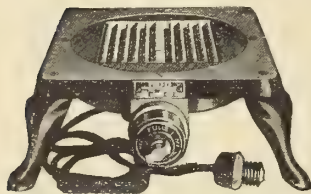


Fig. 52—Hot plate—Hughes Electric Heating Company, Chicago, Ill.



Fig. 53—Portable cleaner—Duntley Products Company, Erie, Pa.

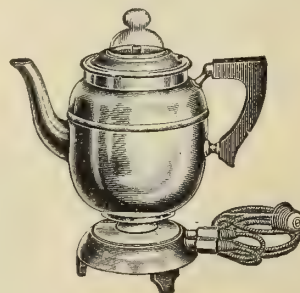


Fig. 54—Coffee percolator—American Electrical Heater Company, Detroit, Mich.



Fig. 55—Electric iron—American Electrical Heater Company, Detroit, Mich.

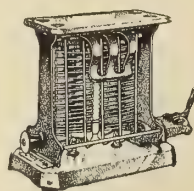


Fig. 56—Toaster — Canadian Hotpoint Electric Heating Company, Toronto.

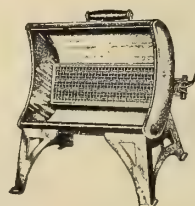


Fig. 57—Radiator — Canadian Hotpoint Electric Heating Company, Toronto.



Fig. 58—Warming pad—Northern Electric Company, Limited, Montreal.





Fig. 59—Portable cleaner—Canadian General Electric Company, Toronto.

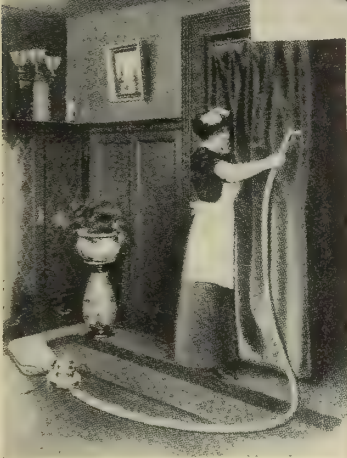


Fig. 60—Universal cleaner—Invincible Renovator Company, Toronto.



Fig. 63—Coffee percolator—American Electrical Heater Company, Detroit, Mich.



Fig. 61—Toaster—Simplex Electric Heating Company, Belleville, Ont.

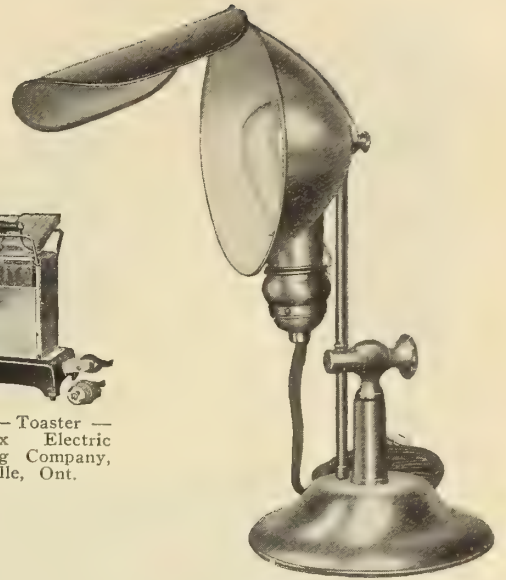


Fig. 62—Reading lamp—Irving Smith, Montreal.

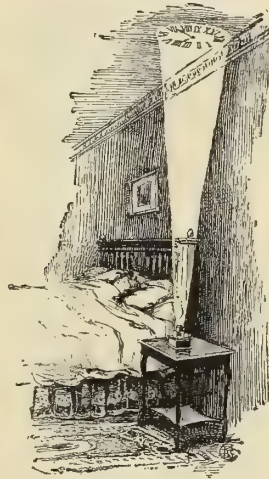


Fig. 64—Ceiling clock—F. I. Spielmann, Montreal.



Fig. 65—Utility motor—Northern Electric Company, Limited, Montreal.

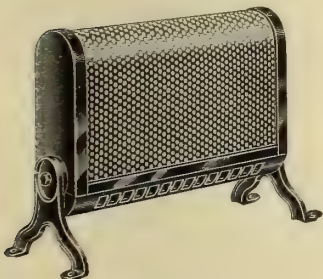


Fig. 67—Portable heater—American Electrical Heater Company, Detroit, Mich.

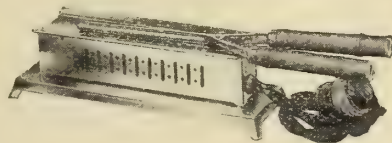


Fig. 66—Curling tongs heater—American Electrical Heater Company, Detroit, Mich.

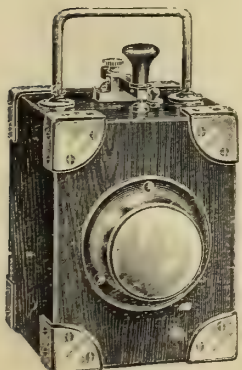


Fig. 68—Portable storage lamp—F. I. Spielmann, Montreal.



Fig. 69—Portable heater—National Electric Heating Company, Toronto.



Fig. 70—Two glow portable—National Electric Heating Company, Toronto.





Fig. 71—Handy lamp—Canadian Ever Ready Works, Toronto.



Fig. 72—Fireless cooker—Standard Electric Stove Co., Toledo.

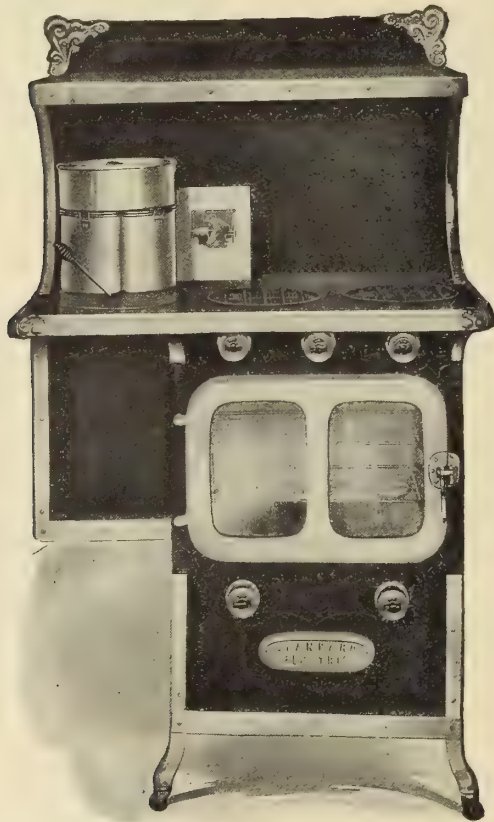


Fig. 73—Electric range—Standard Electric Stove Co., Toledo, O.

manufactured by the Canadian Hotpoint Electric Heating Company, Toronto.

Fig. 58—One of the various uses to which a warming pad may be put. This type is manufactured by the Northern Electric Company, Limited, Montreal.

Fig. 59—A new type of small portable cleaner, the Big Ben, at popular price, now being placed on the market by the Canadian General Electric Company. Though these small cleaners may not be as powerful as the larger and more expensive machines, they can be depended upon to give entirely satisfactory service.

Fig. 60—A form of portable universal cleaner, manufactured in Canada by the Invincible Renovator Company of Toronto. The various operations illustrated indicate the universal application of this machine to all sorts of household cleaning. The Invincible Company have long made the heavier cleaners of highest quality and are now bringing out the Baby Invincible, maintaining the same quality and tool equipment as used on the high priced machines, and at a price within reach of all. The Baby cleaner weighs 10¼

pounds, and costs less than one-half cent per hour to operate.

Fig. 61—Another of the efficient household units manufactured by the Simplex Electric Heating Company, Belleville—a popular priced toaster.

Fig. 62 illustrates what is known as the Lyhne lamp. This lamp is so equipped with shades that the light may be directed and concentrated in any desired position. It is alike useful in the home and in the office. Mr. Irving Smith, Montreal, is the sole Canadian agent.

Fig. 63—Another of the products of the American Electrical Heater Company, Detroit.

Fig. 64—Another view of the F. I. Spielmann night clock, showing the dial projected on the ceiling.

Fig. 65—A utility motor being put to good use in the electrical home. This is one of the most satisfactory labor-saving devices yet manufactured for the electrical trade; can be used to operate sewing machines, grind knives, operate lathes, polishers, etc.; Northern Electric Company, Montreal.

Fig. 66—Another product of the American Electrical Heater Company—a curling tongs heater. Fig. 67 shows a small portable heater also manufactured by this company.

Fig. 68—One of the types of storage lamp handled by F. I. Spielmann.

Figs. 69 and 70 represent two very popular types of electric heater manufactured by the National Electric Heating Company, Queen Street East, Toronto. The stove shown in Fig. 69 consumes 660 watts and is capable of keeping any ordinary room at a comfortable temperature during the late autumn or early spring days when the furnace may not be operating at full capacity. For auxiliary work in extreme weather this electric stove is also an exceedingly valuable asset. Fig. 70 represents a more decorative type, though somewhat less efficient.

Fig. 71 is a product of the Canadian Ever Ready Works, Toronto—a useful portable light which takes a standard 6-inch dry-cell and will give from 20 to 40 hours' service, depending on whether or not it is used continuously. This is an article especially adapted for farm or other country use, and is invaluable to meter readers, plumbers, watchmen or wherever a bright, safe, instantaneous light is required.

Figs. 72 and 73 represent types of stove manufactured by the Standard Electric Stove Company, Toledo, Ohio. Fig. 72 is a smaller type built entirely on the fireless plan. Fig. 73 is a combination of two luminous disc heaters and two aluminium lined insulated cooking compartments or ovens, one with glass front in the oven door for quick baking, roasting, toasting, etc., and one perpendicular, operating with "Water-seal" cover, designed to cook in the fireless way.

## Those Old Fashioned Fixtures

There is a big field awaiting the electrical contractor in homes built and wired eight or ten years ago and fitted according to the requirements and ideas of that period. Electrical installations ten years old are, in the majority of cases, out of date; the fixtures are old-fashioned and uneconomical; the outlets are in the wrong place; and, for the most part, the carrying capacity of the circuits is not sufficient to meet today's demand for the variety of household electrical appliances that have come to be looked upon as necessities.

Many such householders realize the handicaps they are operating under, and speak of the day when they will build a new home properly equipped with all the modern devices, and they do not realize that a comparatively small expenditure would renovate their present system of wiring and make it, if not equal to the best, at least a great deal better than it is at present. The current issue of the National Electrical



Contractor discusses this point, emphasizing the fact that electrical contractors are tumbling over one another to secure a small job in the wiring of a new house, but are entirely neglecting these larger opportunities, and adds:

A study of conditions in the electrical contracting field shows that ninety per cent. of present selling efforts are spent on new buildings or on old buildings not wired for electricity. Naturally these jobs are decidedly competitive and in a number of cases the work is handled at an actual loss.

One difficulty here is the lack of appreciation on the part of the consumer as to what constitutes a well-lighted home. Their ideas on lighting are gathered from the old-fashioned installations they have seen in other homes, and naturally the contractor who talks modern designs has a difficult wall to mount.

Let us take, for example, a typical small town, in which the lighting plant has been operating for ten years. In this town, which is composed largely of retired farmers, seventy per cent. of the houses were wired for electricity when the plant was put in operation. Inexpensive chandeliers of the angle arm type were generally used for the parlor and living room, while drop cords made up the bulk of equipment for other parts of the house.

The houses in this town are probably above the average in size, construction and furnishings, yet the chandeliers are entirely lacking in harmony with the modern furnishings which have replaced those which were in the homes at the time the chandeliers were installed.

When a new house is built here three electrical contractors and the lighting company cut each other's throat in an effort to secure the chandelier work, yet no effort has ever been made to induce these well-to-do owners of homes built ten or twelve years ago to buy chandeliers in keeping with their modern furnishings.

Growth of population in towns of this class is slow. Fifteen new houses a year would tax the resources of the building contractors to the utmost. Yet the writer found twenty-five homes of men rated at \$10,000 and over—men who drove \$2,500 automobiles, owned \$600 pianos and \$450 victrolas—in which the lighting equipment did not exceed two \$15 chandeliers. Rooms not generally visited by strangers were almost universally fitted with drop cords.

Properly approached, the owners of any of these homes were live prospects for a \$100 or \$150 chandelier order. An appeal to their pride, comfort, or some other personal weakness which could be connected with the use of better chandeliers, would have put them in a buying frame of mind. Still the local contractors had never considered them as prospects.

As near as we can learn this is not an unusual case, excepting possibly that the wealth of the unworked prospects was above the average. The trouble seems to be that the contractors are too close to their market to view it in proper perspective. A new job which includes wiring, etc., attracts them immediately, but owing to present day competitive methods it frequently results in no actual profit.

What would prevent a live electrical contractor, located in one of the thousands of towns similar to the one described, from building a profitable department for his business through the sale of one or more modern chandeliers to these owners of old homes.

After the plan was put in operation there would be some competition, of course. But it would be a competition of quality rather than price, and in most cases the competitive feature would not figure as the prospects would not be in the shopping mood.

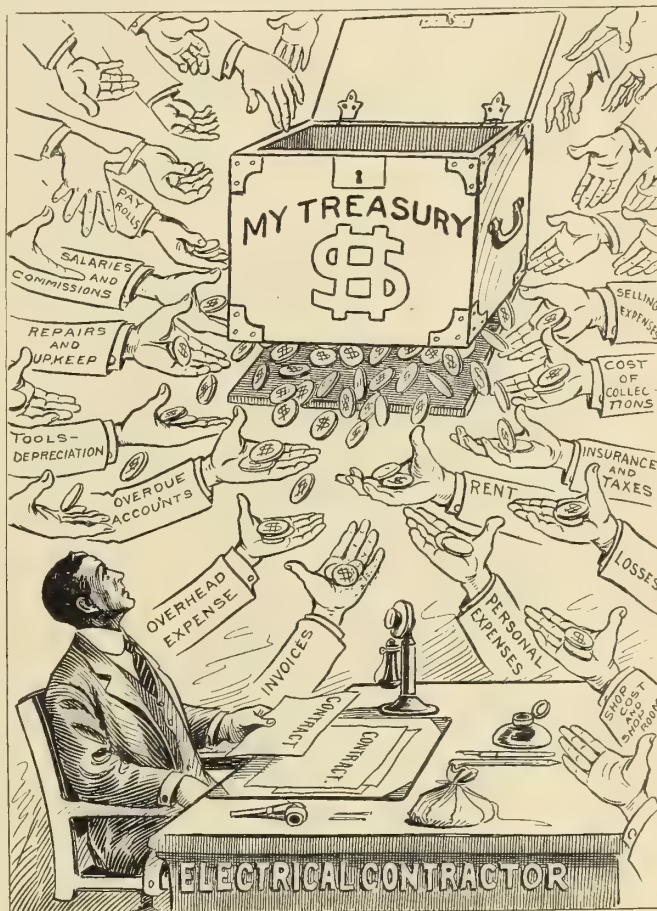
New contracts are desirable, to be sure. Fixture manufacturers want them, and want electrical contractors to get them. But the field described is equally desirable. It is infinitely larger, it can be worked at any season and it gets away from the price-cutting evil because competitors can

not learn where the electrical contractor is concentrating his efforts.

In addition to this, the sale of these new type chandeliers will mean the sale of new lamps, and will prepare the way for the sale of other electrical household devices which will add to the contractor's profitable business.

### The Unsuccessful Contractor

This is the way the National Electrical Contractor explains the failure of so many so-called electrical contractors to make good. It evidently needs a pretty efficient accounting system to take correct note of all the little leaks, but it



seems to be the only way. Otherwise it is inevitable that sooner or later the bottom falls out of your treasury—and your business—and you are numbered with the majority.

### Weston Electrical Testing Instruments for the Garage

Electrical measuring instruments are urgently needed in all well-equipped public garages at the present time. The reason they are needed is that one of the most useful and permanent advances in connection with gasoline automobiles has been the introduction of electric starting and electric lighting systems on substantially all gasoline automobiles of recent model. Until two or three years ago the electrical circuits of a gasoline automobile consisted mainly of such wiring as was required for the ignition system, and while electrical measuring instruments have always been desirable as a part of a garage equipment, they were not heretofore indispensable. This condition has changed, however, because the extensive use of the present-day electrical equipments will necessarily increase the number of causes that may interfere with the satisfactory operation of a car, and consequently garages must be prepared to remedy electrical troubles of a nature that did not exist previously.

Weston Model 280 volt-ammeter, with external shunts

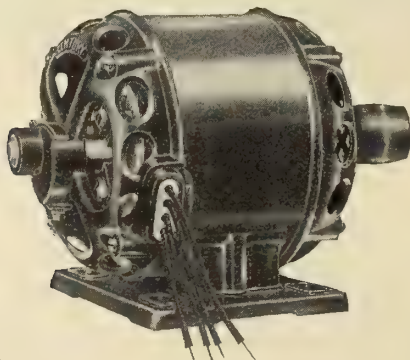


for ampere measurements, is designated the Weston Garage Testing Instrument, and is superior to any instrument of its character and size that has ever been offered for sale. The selection of ranges is that which experience has demonstrated to be the best combination for the large number of garages that feel compelled to limit their electrical testing investment to the purchase of a single instrument. This instrument is extremely serviceable, and will prove of invaluable assistance to the employees in any garage. It is compact (pocket size), has a uniform and legible scale, is extremely accurate and serviceable, perfectly dead-beat, quick in action, shielded from the disturbing influence of external magnetic fields, exceptionally permanent and durable. It is adjusted for ranges of 30 and 3 volts and 100 millivolts (all self-contained), and is provided with external shunts of 3, 30 and 300 ampere-rating for use in current measurements.

As an indication of the serviceability of these various ranges, the 30-volt range is useful for determining the voltage of the starting or lighting system of batteries. The 3-volt range is of service in testing the individual storage batteries. The 100-millivolt range may be used to determine the "drop" over segments of the commutator of the motor or generator. The 3-ampere range is of value in testing the current required by single lights. The 30-ampere range will denote the current required by a complete lighting circuit or the magnitude of leaks. The 300-ampere range is useful to determine the starting current. The foregoing are merely a few of the tests that may be made with the instrument, but they serve to show the variety of tests that are made in a garage, to which any make of automobile and hence any make of electric-starting, lighting or ignition system may be brought for attention. These testing instruments are for sale by the Northern Electric Company, Limited, who are Canadian agents for the Weston Electrical Instrument Company, Newark, N.J.

#### Starts Under Full Load

The Century Electric Company, St. Louis, are meeting the demand among central station operators for a small a.c. motor capable of starting under full load with a low starting current by the addition of a 1-6 h.p. motor to their regular line. This motor is capable of starting on the small fuses



New Century 1-6 h.p. a.c. motor.

usually found in residence districts, develops a high torque and is of the repulsion starting, induction running type.

The same general design and construction prevails in this motor that is characteristic of the remainder of the "Century" line. It is capable of developing a starting torque more than two and one-half times full load torque with a starting current of less than three times full load current, and capable of developing a maximum, when it is up to speed, of approximately 200 per cent. of full load torque. It is equipped with phosphor bronze ring oiling bearings which makes it especially valuable for the operation of apparatus which is located in places where the motor is subjected to

low winter temperatures. The standard winding is 104-208 volts interchangeable which enables the manufacturer to equip his apparatus with motors and put the complete equipment in stock with reasonable assurance that the motor can be used on either of the prevailing voltages usually found in this country.

#### A Salesmen's Convention

The Robbins & Meyers Company, Springfield, O., held their annual convention of branch house managers during the week of October 19th. In addition to the managers, each branch house had one or two salesmen in attendance. Among



An ideal convention headquarters.

the business features of the convention may be mentioned the discussion of such subjects as credits and advertising, the sale of fans, the sale of motors, and so on. At the close of the general conference, the whole party was carried in the company's motor trucks to the Log Cabin, the forest camp belonging to Mr. Warren Myers, where refreshments and a general good time were served. The accompanying illustration shows the pleasurable conditions under which this final session was held.

#### Hangstrait Hickey

There are few jobs where the wireman or fixture hanger finds outlet boxes level, or studs or drops straight, or where he does not run into crooked threads which finally have the same result. To relieve these troubles of the past there has been developed a new approved adjustable ball and socket joint hickey with an angle of possible correction sufficient to take care of a fixture 12 ins. long that will be 4 ins. off centre, or a 6-ft. fixture 24 ins. out of plumb. By a slight cutting off



Adjustable ball and socket hickey.

of the corners of one side of the cup with file or emery wheel the angle of pitch may even extend beyond 45 deg.—a feature very valuable when outlets occur on a sloping ceiling such as is found with saw tooth construction or under theatre balconies, stairways, etc. The new hickey is made of high grade malleable iron, and is of great mechanical strength, small, neat, compact, and low in price. It is furnished complete



with a tripod, crow-foot or outlet box stud or made to fit insulating joints, the bottom of which may be either male or female,  $\frac{1}{4}$ -in. or  $\frac{3}{8}$ -in. standard pipe size, and to connect to fixture stems of  $\frac{1}{8}$ -in.,  $\frac{1}{4}$ -in. or  $\frac{3}{8}$ -in. standard pipe size. The minimum overall length of this hickey with an insulating joint is less than one-inch greater than the ordinary hickey and insulating joint. As a time saver it is a 10 per cent. to 50 per cent. reduction on the average cost of hanging electric fixtures. One man can handle any fixture not too heavy to lift. Long arm, wide spread fixtures are just as simply and easily hung as the plain stem fixture as there is no turning or twisting of the fixture necessary. After the crow-foot or insulating joint with the ball fitting has been attached, the fixture is hung by slipping the bolt through the hole in the ball, swinging up the hinged half of the cup or socket and screwing up the wing nut. The fixture hangs plumb and cannot twist or swing. A tightening of wing nut leaves the joint rigid. The trade name Wico Hangstrait Hickey has been given to this new article. It is manufactured by the Wilton Manufacturing Company, Wrightsville, Pa.

#### New Molded Insulation Cover

There has been a demand for a connector having an insulated cover, for use without solder for the small sizes of wires. Heretofore this demand has been partly met by the Dossert Special No. 1 connector but as this connector was designed to take all sizes of wire and cable from No. 1 to No. 14, the range was believed to be wider than necessary. Through Mr. Irving Smith, Montreal, Canadian representative, Dossert & Company, New York, announce a molded insulation cover for use on their regular No. 4 connector. This connector will take all sizes of wire from No. 4 to No. 14. By making the insulating cover for the regular No. 4 connector the fitting is reduced in size and with less material there is also a reduction in cost, to users, of about 20 per cent. as compared with the cost of the connector and cover heretofore supplied for small sizes of wire. With these connectors various size bushings are provided, the outside diameters of which fit the connector while the inside diameters correspond to the size of wire that it is desired to connect.

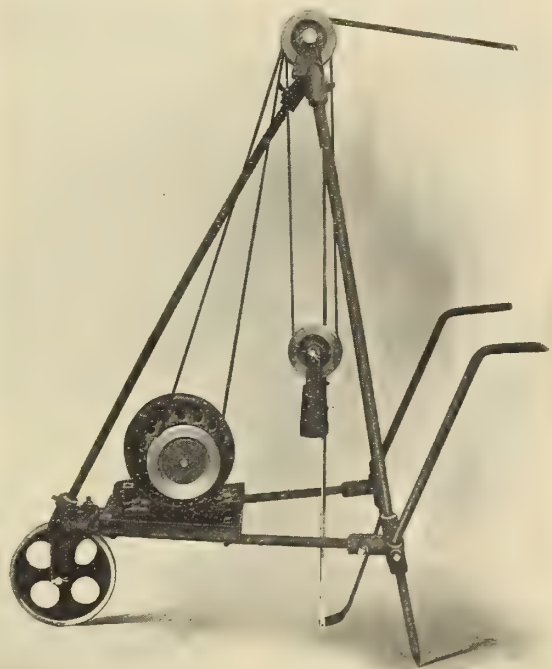
#### Manufacturing Electric Toys

The Perkins Electric Company, Limited, Montreal, have entered the field of manufacturing electric toys, for which Canada has hitherto had to depend almost entirely on outside supplies. The company are now engaged in this new branch, and will be in a position to make deliveries in time for the Christmas trade. Three lines are being made in Montreal—one, a small electric motor, which can be operated on any voltage between 2 and 8, one dry cell being required for every two volts. The apparatus is fitted with pulley, enabling it to be used for driving other toys and light articles. Another line, a small medical or shocking coil, of neat design, can be operated from one dry cell. The third line is a controller, principally for use with electrical trains, and is manufactured for use direct from the house service circuit. We are informed that the trade is very generously supporting the efforts of the company to create a new industry, and that orders for forward delivery should be received promptly.

#### A Device of Special Interest to Planing Machine Owners and Operators

Modern planers and matchers are equipped with thin high speed steel knives which are most conveniently and with little loss of time, ground keen in the cutterheads on the machine. An Universal Grinder which may be used on any planer of the make it is built for, is used for this purpose, and is driven by any one of several different types of power rigs, one of which is illustrated. The rig shown here

is probably the most convenient to use where current is available and where several planers are installed. It is called The Berlin Portable Tripod Power Plant by its makers, the Berlin Machine Works, Limited, Hamilton, Ont., and is intended specifically for use in connection with planing machines of that firm's make, for furnishing power for the Universal grinders with which their planers are equipped. It is a very simple and thoroughly efficient little appliance, consisting of a  $\frac{3}{4}$  h.p. electric motor mounted in a portable steel tripod, two legs of which are pointed to stably position the rig wherever anchored. The third leg is mounted on a cast iron wheel, and it will be seen that the device may be easily moved about and positioned as desired. In some mills one of these rigs is taking care of the knife-grinding requirements of several machines. To complete the adaptability of the rig the motor will be furnished for either alternating or direct-current, complete with starting mechanism, where the latter is necessary. The alternating current motor is of the constant speed induction type, while the one furnished for direct current use is of the constant speed, shunt wound



Portable tripod power plant.

type. Current for the motor is taken through any ordinary lamp socket, or special wall boxes may be provided. Round belts running in deep-grooved sheaves transmit power from the motor to the grinder. A weighted sheave in the tripod works freely up and down on a square steel rod as the operator slides the grinder back and forth across the knives, keeping the belt always at the proper tension.

#### For the Christmas Trade

The Canadian General Electric Company, Limited, expect to offer in time for the Christmas trade, a new and up-to-date heating device in the form of an inexpensive Electric Utility Grill. This grill, while inexpensive, will be very substantially built and the field for its usefulness as a domestic appliance will be very wide. This grill may be used as a stove, as a toaster, as a broiler or as a grill. It will have a radiant spiral wound coil unit of 600 watts capacity, single heat, and will be supplied with attachment plug, six feet of cable and socket attaching plug.



### Opened Offices as Manufacturers' Agent

Mr. Chas. B. Ellis, until recently manager of the Economy Fuse & Manufacturing Company of Canada, Limited, has opened an office at 301 Power Building, Montreal, as manufacturers' agent. Among other lines, Mr. Ellis is handling the exclusive agency for the Dominion of the Beers Electric Hand Lantern, manufactured by the Bridgeport Metal Goods Manufacturing Company. This lantern operates on an ordinary No. 6 dry cell and is a very popular line.

### Universal Insulator Supports

The Steel City Electric Company, Pittsburgh, are placing on the market a number of new designs in their Universal insulator supports. Fig. 1 shows a one-inch support with two No. 5½ split insulators. The support is tapped special-

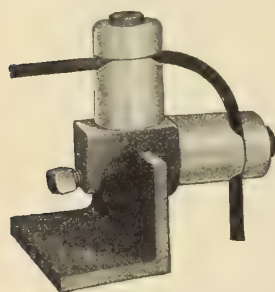


Fig. 1

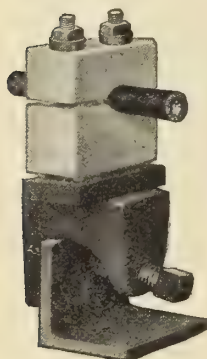


Fig. 2

ly for 10-24 thread machine screw. Fig. 2 shows a two-inch support with attachment for type 8 No. 2 B & D cleat. Support is tapped standard for No. 24-16 thread machine screw. Fig. 3 shows a 2½ inch support with wood pin and D.G., D. P. glass insulator. Support is tapped standard ½-inch 13 thread for sherardized bolt which goes through centre of wood pin.

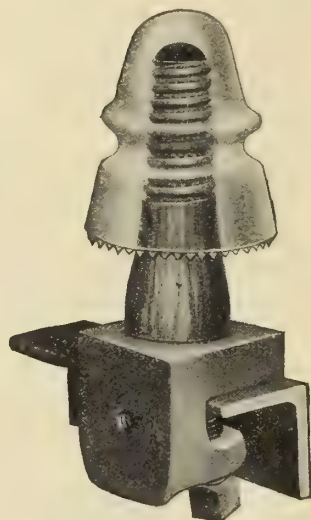


Fig. 3

### Must Use Full Capacity Switches

The following letter has been sent out by the Hydro-electric Power Commission of Ontario, and settles a point about which there has been considerable controversy. The information contained therein will be of interest to many of our readers.

November 7th, 1914.

Dear Sirs,

A considerable amount of misunderstanding has occurred throughout the Province between electrical contractors and the inspectors as to the correct interpretation regarding 600-Volt Knife Switches. We therefore wish to advise you as to the correct understanding in order to obviate any inconvenience or loss of time to any parties concerned.

The point at issue between the principals in these discussions is whether the 500-Volt switch is permissible on a 550-Volt circuit. The correct decision in this matter and the one which will be enforced by inspectors under our jurisdiction is as follows:

That all approved knife switches marked 250 volts d.c. or 500 volts a.c. are only permitted for use on circuits where there is a maximum difference of potential not exceeding 500 volts a.c. Where the pressure is between 500 and 600 volts the specification for 600-volt switches will be called for. It is, however, permissible to use the former switches on 550-volt circuits providing there are proper barriers between the blades.

With reference to the words "proper barriers," we would point out that make-shift barriers such as strips of asbestos or other substitutes will not be acceptable, and we would suggest that at your convenience you submit a sample of this style of switch and receive formal approval of the same.

Yours truly,

Hydro-electric Power Commission of Ontario,  
Chief Engineer.

### Appoint Canadian Agents

The General Devices & Fittings Company announce that they have appointed the following agents to look after their Canadian interests:—

Bentz-Richardson Company, Limited, 11 Phoenix Block, Winnipeg, Manitoba, Western Canada Sales Agents.

A. H. Winter Joynes Limited, 76 Bay Street, Toronto, Ontario, Ontario Sales Agents.

Roper, Clarke & Company, Limited, Coristine Building, Montreal, Quebec, Eastern Canada Sales Agents.

### Trade Publications

**Glassware.**—Three booklets issued by Gill & Company, Inc., Philadelphia, describing respectively Velva glassware, Inca glassware and Una glass globes and shades.

**Helping the Woodworker.**—Booklet issued by the Westinghouse Electric & Manufacturing Company, explaining how the woodworker may increase his production, decrease his costs and improve his quality by the application of electricity through electric motors.

**Machine Tool Service.**—Catalogue No. 3002-A. issued by the Westinghouse Electric & Manufacturing Company, illustrating and describing the application of their electric motors in machine tool service.

**Electricity in Coal Mines.**—Catalogue issued by the industrial and power department of the Westinghouse Electric and Manufacturing Company, describing the application of central station power, through Westinghouse equipment, to the coal mining industry.

**Wiring Specialties.**—Supplementary catalogue, issued by the Arrow Electric Company, of Hartford, describing their latest additions to their line of wiring specialties.

**Motor Transportation.**—Illustrated booklet issued by the General Vehicle Company, Long Island City, through the Canadian General Electric Company, illustrating and describing efficient motor transportation in G.V. electrics.

**Theatre Dimmers.**—Booklet issued by the Cutler-Hammer Manufacturing Company, Milwaukee, describing a number of installation views of theatre dimmers, including illustrations showing installations of ventilating fan regulators and d.c. and a.c. types of automatic starters for motor-driven pumps and blowers.

**Air-Brake Equipment.**—Bulletin No. 44565, issued by the Canadian General Electric Company, describing and illustrating variable release air-brake equipment.

**Portable Voltmeter.**—Bulletin No. 46018, issued by the Canadian General Electric Company, describing their type P-8 portable voltmeter.

**Induction Motors.**—Bulletin No. 123 issued by Robbins & Myers, Springfield, Ohio, describing, with illustrations, type K polyphase induction motors.



# “Circle T” Armored Cable



If you use “Circle T” Armored Cable you will have the following advantages: You won't get imperfect windings. You won't get cable that breaks. You will have an even cable that runs absolutely uniform. “Circle T” Cable is made to fit standard fittings.

The following result of a test shows the good quality and workmanship of “Circle T” Cable. We looped the cable and pulled both ends until cable was down to  $1\frac{1}{4}$ " in diameter before the winding gave way. Our average test is  $1\frac{1}{2}$ ". Other makes opened up at 2" and  $2\frac{1}{2}$ ".

The “Circle T” trade mark is stamped on the outside of the metal about every six inches.

*SAMPLES ON REQUEST.*

## The Trumbull Electric Mfg. Co.

PLAINVILLE, CONN.

NEW YORK  
114-118 Liberty St.

CHICAGO  
15 S. Desplaines St.

BOSTON  
76-78 Pearl St.

PHILADELPHIA  
138 N. 10th St.

SAN FRANCISCO  
84-88 Second St.



# Current News and Notes

## Carlyle, Sask.

The town's electric light plant was set in operation for the first time on Saturday, October 31st. The hours of service will be from dusk to 12.30 and from 6 to 9 a.m.

## Chatham, Ont.

A number of representative citizens recently journeyed to Windsor, Ont., to make a study of the lighting system in that town. It is understood that the Windsor lights created a very favorable impression and that Chatham's new system, if it goes through, will be similar.

## Delaware, Ont.

The Village Council is planning to install a lighting system and also equipment for distributing power to various consumers.

## Edmonton, Alta.

Application will be made at the next session of the local legislature for an act incorporating the Edmonton North Western Radial Railway Company with power to construct and operate a railway or tramway by power other than steam from Edmonton in a north-westerly direction to a point at or near the Pembina River.

## Fergus, Ont.

Hydro power was turned on in Fergus on Friday, October 23rd.

## Flesherton, Ont.

The electors carried a by-law to expend \$5,500 on an electric distribution system.

## Galt, Ont.

The by-law authorizing the expenditure of \$5,500 in additions to the water works system carried.

## Guelph, Ont.

Contracts have just been closed for the supply of blocks of 40 and 50 h.p. to the Canadian Metal Products, Limited, and the Guelph Lumber Company, respectively.

## Kamloops, B.C.

Work on the hydro-electric plant, which will supply the city of Kamloops with light and power, is making steady progress. It is expected that the plant will be in operation very shortly.

## Kingston, Ont.

Kingston township ratepayers will vote on January 1st to grant a 30-year franchise to Mr. J. M. Campbell for the supply of electric power. It is understood a number of the farmers in the township are eager to install equipment for power and light.

## London, Ont.

City Solicitor Meredith has been authorized by the Board of Control to make application in the city's behalf to the Dominion Railway Board for power to order that all telephone, telegraph and distributing electric wires be placed underground.

## Montreal, Que.

The contract for the construction of underground conduits in St. Lawrence Street from Notre Dame to the river frontage has been awarded to Mr. G. M. Gest. The understanding is that Mr. Gest will employ only Montreal workmen and, as far as possible, married men will be given first choice.

The Montreal Council have passed a by-law allowing the Montreal and Southern Counties Railway Company to ex-

tend their tracks across McGill Street to Youville Square, with the object of extending the terminals. The city stipulate that it will take no legal responsibility, this clause being inserted in view of the contract of the City with the tramways company, whose lines run along McGill Street. The work is to be commenced before the 1st of January and completed in six months.

Owing to the giving way of the cofferdam at the head of the canal at the plant of the Cedars Rapids Manufacturing and Power Company, the water has been turned in sooner than was expected. It had been anticipated that the water would be in early in November, but on Friday, October 30, the barrier gradually gave way, owing to natural causes, and to a certain extent upset the plans of the engineers. Fortunately, preparations had been made almost completed for the admittance of the water. The excavation material carried into the canal will be removed by dredging.

The City Council of Maisonneuve, P.Q., have passed a resolution protesting against the nuisance caused by locomotives within the city, and requesting the Railway Commission to order the use of electric locomotives by the companies whose lines run through the city.

During the fiscal year ended June 30 the Montreal and Southern Counties Railway carried 1,915,379 passengers, an increase of 254,134 over the corresponding twelve months, 1913. The company has completed the fifth year of its existence.

Further steps have been taken by the Montreal Board of Control with a view to the city undertaking the work of electrical inspection now being carried out by a department of the Canadian Fire Underwriters' Association. The question has been referred to the Legislation Committee of the Council.

The General Railway Signal Company of Canada, Limited, Montreal, have transferred their executive offices from Lachine to 625 Transportation Building, Montreal.

New regulations governing the construction and erection of electric signs have been adopted by the Montreal Council. The by-law forbids the illumination of signs except by means of electric bulbs forming each letter or figure of the advertisement. The by-law applies to signs hanging more than six inches from the buildings to which they are attached, and which have been erected previous to the passage of the by-law. The signs must not protrude more than six feet from the buildings. The space to be illuminated is fixed at not less than 75 per cent. of the total area. Before permission is given to erect a sign a certificate must be submitted to the effect that the electric wiring of the sign and the arrangement of its electrical fixtures are in accordance with the rules and regulations of the Canadian Fire Underwriters' Association.

Mr. R. A. Ross, consulting electrical engineer of Montreal, will represent the City of Peterborough, Ont., in the public arbitration for taking over by the city of the plant of the Peterborough Light and Power Company.

The Canadian Underwriters' Electrical Inspection Bureau Limited, Montreal, has been incorporated with a capital of \$25,000. The company's charter covers a wide area, but the chief business will be the inspection of electrical work, appliances and installations, which has hitherto been carried out by the electrical department of the Canadian Fire Underwriters' Association. Mr. C. M. Tait, the chief electrical inspector, is one of the incorporators of the



# Condensed Department

## Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure in section in the subsequent issue.

## Prince Rupert, B.C.

Applications will be received by the undersigned up to November 30th, 5 p.m., for the positions of chief and three shift operators for hydro-electric plant. Applicants must be thoroughly familiar with both water and electrical end of the business. Experience and salary required to be stated and copies of references sent

E. A. WOODS,  
City Clerk.

22

## Electric Generator

Wanted—A good second-hand generator capable of supplying 250 to 300 lights. Must be in first class condition. Quotations also received on new generator of same capacity. Clarke Bros., Bear River, N.S. 21-22

## Sales Engineers Wanted

A large firm specializing in the manufacture of motors of all classes desires to secure sales engineers in various parts of Canada. Firms who can carry a stock of motors are preferred. Write stating the territory that you can cover. Box 96, Electrical News, Toronto. 21-24

## Agents Wanted

Large firm making a complete line of electric centrifugal pumps; automatic electric compression water systems; electrically driven multi-stage turbine pumps; electrically driven double acting pumps and a number of other lines, want sales agents for various parts of Canada. Write stating what territory you can handle. Apply Box 94, Electrical News, Toronto. 21-23

## Agents Wanted

Large firm making low voltage transformers and electrical measuring instruments wants sales agents for Canada. These transformers are for sign lighting, bell ringing, and toy requirements. The electrical measuring instruments include a complete line of switchboard and portable Ammeters and Voltmeters. All agents to work on a commission basis. Write stating what territory you can handle. Box 93, Electrical News, Toronto. 21-23



## SECOND HAND ELECTRICAL MACHINERY

Bought, sold, rented, and exchanged.  
We have the largest stock in America.  
Send for our monthly bargain sheet showing complete stock with our prices.



Established 1893

## Electrical Machinery

Motors, Dynamos, Generators,  
Electrical Pumps and Supplies.  
Electrical Contractors.  
Motor Repairs.



52 Queen Street - OTTAWA

PROCURED IN ALL  
COUNTRIES  
LONG EXPERIENCE  
IN PATENT LITIGATION

SEND FOR HAND BOOK

**PATENTS**  
RIDOUT & MAYBEE

PHONE  
MAIN  
2582

59 Yonge Street

TORONTO, - - - CANADA

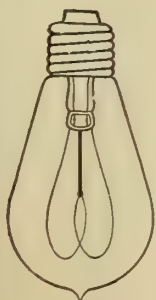
## Lighting Schedule for December, 1914

Courtesy of the National Carbon Company, Cleveland

Date.	Light.	Date.	Extinguish.	No. of Hours
Dec. 1	No Light	Dec. 1	No Light	
2	No Light	2	No Light	
3	No Light	3	No Light	
4	5 00	4	7 20	2 20
5	5 00	5	8 30	3 30
6	5 00	6	9 30	4 30
7	5 00	7	10 40	5 40
8	5 00	8	11 50	6 50
9	5 00	10	1 00	8 00
10	5 00	11	2 10	9 10
11	5 00	12	3 20	10 20
12	5 00	13	4 30	11 30
13	5 00	14	5 50	12 50
14	5 00	15	6 40	13 40
15	5 00	16	6 40	13 40
16	5 00	17	6 40	13 40
17	5 00	18	6 40	13 40
18	5 00	19	6 40	13 40
19	5 00	20	6 40	13 40
20	5 00	21	6 40	13 40
21	5 00	22	6 40	13 40
22	5 00	23	6 40	13 40
23	10 30	24	6 40	8 10
24	11 30	25	6 40	7 10
26	0 30	26	6 40	6 10
27	1 30	27	6 40	5 10
28	2 30	28	6 40	4 10
29	3 30	29	6 40	3 10
30	4 30	31	6 40	2 10
31	No Light	Jan. 1	No Light	

Total Hours.....233.50

# See Things In a Better Light—and Buy OUR UNBREAKABLE TUNGSTEN and CARBON LAMPS



Every lamp sold under a positive guarantee of satisfaction—both to you and to your customers.

These lamps are made by the best lamp manufacturers in the world, and consume much less current than inferior brands.

70,000—10 watt 110-115 or 120 volt Tungsten lamps in case lots of 500 at 19c each. Send for sample.

GET OUR SPECIAL WAR DISCOUNTS

**Volt Electric Company, Limited,** 37-41 Britain Street  
Toronto, Ont.





new company, which will be affiliated with the Underwriters' Association.

The Montreal Electrical Society opened its winter session on Monday, November 2, when Professor A. M. Gray spoke on "Power Factor." The meeting was held in the Engineering Building, McGill University, the free use of which has been granted by the University for the entire session. The meetings will be held on the first Mondays in the month.

#### Newmarket, Ont.

At a special meeting of the Town Council a resolution was passed requesting the Hydro-electric Power Commission of Ontario to submit an estimate for the supply of current to the municipality.

#### Niagara Falls, Ont.

It is understood that the Electric Light Committee will call for tenders for the installation of a new lighting system. A representative committee recently visited Hamilton, and the new Niagara Falls system will probably be fashioned along similar lines.

#### North Toronto, Ont.

At a public meeting recently held in this town, the suggestion was made that the Hydro-electric Power Commission should buy out the Metropolitan division of the Toronto & York Radial Railway System. A committee will wait on the Toronto Board of Control to urge the construction of a municipal railway through Mount Pleasant Cemetery north and south, connecting at the south end with the St. Clair Avenue car line.

#### Oakwood, Ont.

Residents in the district between Mulberry and Kennedy Avenues have recently been supplied with house lights by the Toronto Electric Light Company.

#### Orillia, Ont.

Owing to dredging operations at present going on, water in the Severn river is very low, and at certain hours of the day insufficient to carry the load demanded of the plants at the Big Chute and the Ragged Rapids. Up to November 1st water in a number of Ontario rivers was unusually low.

#### Ottawa, Ont.

Application will be made to the Dominion Parliament at its next session by the Brantford and Hamilton Electric Railway Company for an extension of time within which the company may commence and complete certain of their lines.

Notice is given in the Canada Gazette that the corporate name of "Electrical Properties Limited" has been changed to "Western Electric Company, Limited."

#### Owen Sound, Ont.

Mr. Joseph McLinden, superintendent of the electric light plant, has made the suggestion that, when Eugenia power is brought to Owen Sound and the present steam plant will be needed only for emergency purposes, this plant might be used permanently in connection with a central steam heating system.

#### Regina, Sask.

The operation returns of the Regina Municipal Railway System for the week ending October 31st, were:—Revenue, \$2,819.80; passengers carried, 70,334.

The Telephone Department of the Saskatchewan government has just issued a report covering the fiscal year ending April 30th, 1914. During the year a total of 251 applications for the incorporation of rural telephone companies were received, of which 140 were approved. There are now in Saskatchewan 368 private telephone systems.

Telephone communication between Saskatchewan and Alberta has now been made possible by the completion of a long distance telephone line from Gull Lake, Sask., to the Alberta boundary, where it connects with the Alberta system.

#### Shelburne, Ont.

At a recent meeting of the ratepayers, it was unanimous-

ly decided to submit the question of getting a supply of electric power from the Hydro-electric Power Commission of Ontario at an early date.

#### Simcoe, Ont.

A contract has been awarded for the erection of the new hydro-electric sub-station. Work on the distribution system is already under way.

#### St. John, N.B.

The St. John Board of Trade has taken the initiative in a movement for a British-owned cable between the Dominion and the Mother-land. The prevailing feeling in Canada today is that national and commercial considerations urgently demand a State-owned cable, if not a State-owned telegraph system. Such cable communication, while tending to cement still firmer the bond between Britain and her overseas Dominion, would also be of great advantage commercially, not only to Britain and to Canada, but to the British possessions in the Pacific that are now connected by cable with this country. Some years ago, Sir Sandford Fleming, the distinguished Canadian engineer, tried to awaken an interest in a British-controlled cable, but he did not succeed. Canadians today see their national interests more clearly, and a State-owned cable has become imperative.

#### St. Thomas, Ont.

The Western Ontario Electric Company, Limited, contractors and dealers in electrical supplies, 380 Talbot Street, St. Thomas, has made an assignment.

#### Tillsonburg, Ont.

The unused electric plant of Barkey Brothers at Tillsonburg was recently destroyed by fire.

#### Toronto, Ont.

Work has commenced on the construction of the Bloor Street West civic car line.

The Ninth Annual Convention of the Canadian Independent Telephone Association was held in Toronto on Wednesday and Thursday, November 11th and 12th.

The report which was more or less widely quoted some time ago, that the Ontario government was allowing the export of power to Detroit, has been denied. It is true that negotiations were carried on at one time, but these fell through many months ago, and it is very unlikely that the matter will come up again.

The firm of Chapman & Walker, Richmond Street West, electrical contractors and supplies, has assigned.

The Hydro-electric Power Commission of Ontario have decided to amend their rules and regulations on inside wiring by the addition of a new clause to be known as Clause E, at the end of knob and tube wiring, page 65, which will read as follows:—"Flexible conduit must be securely held in place where entering switch or outlet boxes by an approved fitting or device."

By a recent order of the Ontario Railway and Municipal Board, the Toronto Railway Company is required to place 50 more new cars in service before June 1st, 1915. They are also required to reconstruct 13½ miles of track, to have the Terauley Street line operating to College Street by December 1st, 1914, to extend their tracks in the Ossington Avenue district to Lansdowne Avenue, and to report to the board before January, 1915, on the cost of an improved heating system for the cars. In refusing the city a number of their demands it is pointed out by the board that the earnings of the company have dropped off considerably during the past summer, and also that the franchise has only some seven years to run.

#### Woodstock, Ont.

The Woodstock Water and Light Commission have voted \$500 to the Oxford Patriotic Fund, and \$500 to the Belgian Relief Fund.



# UNDERGROUND CABLES

## LOW AND HIGH TENSION

FOR LIGHTING,  
POWER,  
STREET-  
RAILWAYS,  
TELEPHONE,  
TELEGRAPH.



ARMoured  
CABLES FOR  
STREET  
LIGHTING,  
PAPER  
INSULATED  
CABLES OF ALL  
DESCRIPTIONS,  
RUBBER INSULA-  
TED CABLES &c.

Also Bare and Weatherproof Wires and Cables,  
Magnet Wire, Flexible Cords, &c.

### Galvanized Iron Wire and Strand

HEAD OFFICE:

## MONTREAL, CANADA

BRANCHES:

Toronto,

Winnipeg,

Halifax,

Vancouver.



## Let Us Light Your Factory

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We make  
**Motors and  
Generators**  
For All Circuits

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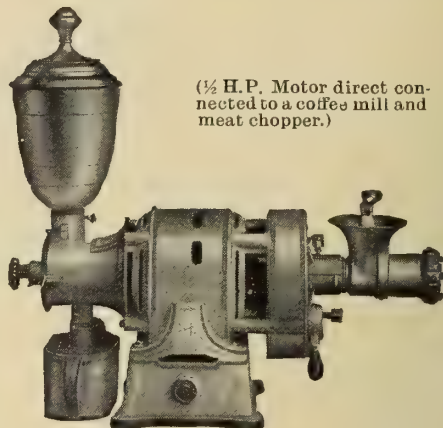
WRITE

**Toronto & Hamilton Electric Co.**  
HAMILTON, ONT.

The high starting torque developed by

*Century*

**Single Phase Motors**



(½ H.P. Motor direct connected to a coffee mill and meat chopper.)

enables them to start a coffee mill with the burrs full of coffee.

They keep-a-running.

**Century Electric Company**

19th, Olive to Pine Sts. ST. LOUIS, Mo.

CANADIAN AGENTS

Jones & Moore Electric Co., Ltd.  
294 Adelaide St. W., Toronto  
Mainer Electric Co., Ltd.  
Winnipeg and Edmonton

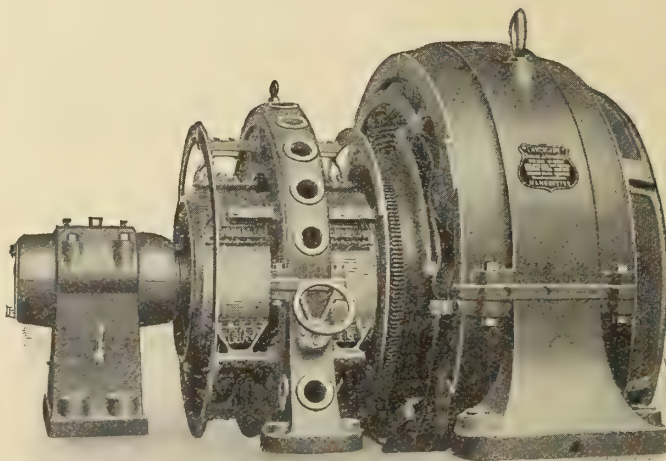
Rudel-Belnap Machy. Co., Ltd.  
Canadian Express Bldg., Mont  
Rankin & Cherrill  
547 Main St., Vancouver

134

We have a large stock of motors up to 100 H.P. in Toronto ready for immediate delivery

The "Lancashire" Ball Bearing Induction Motor and "Patent Reversing Drive for Metal Planers," will repay investigation.

Discriptive matter sent on request.



1000 H.P. Variable Speed Motor for Direct Coupling to Tyre Rolling Mill.

Accidents will happen, but a complete stock of spare parts and well equipped repair shop ensure users of "Lancashire" machines, minimum inconvenience from such breakdowns.

**The Lancashire Dynamo and Motor Co. of Canada, Ltd.**

Montreal

107-109 Duke St., Toronto



ALWAYS IN STOCK,

# MORRIS CHAIN BLOCKS

THEY NEVER BETRAY.

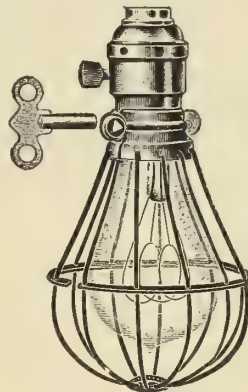
**THE HERBERT MORRIS CRANE  
& HOIST CO., LIMITED**

MPRESS WORKS,

PETER STREET, TORONTO

# LOXON LAMP GUARD

THE KEY TO SAFETY



## Sells on Sight

In recommending all jobbers and dealers to stock Loxon Lamp Guards, we do so in the firm conviction that little argument will be needed on their part to influence the sale of this article.

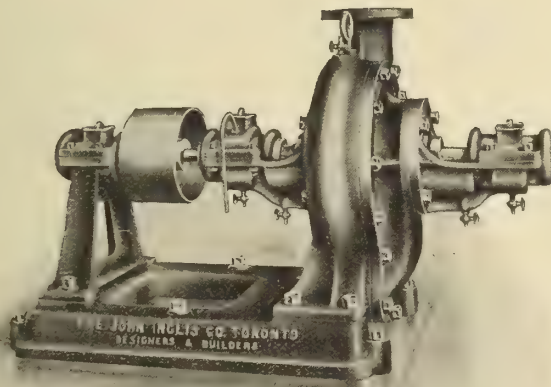
The Loxon Lamp Guard, which locks the lamp into a socket with a key, prevents theft and breakage and reduces Fire Danger from hot or broken lamps to a minimum.

The Loxon Guard embodies strength of construction with a neat appearance. The Loxon Guard is a universal necessity on account of the big part it plays in the promotion of the "Safety First" movement.

Write for catalogue of our Electrical Specialties.

**McGill Mfg. Co.** 5 Oak St.  
Valparaiso, Ind.

# "INGLIS" TURBINE PUMPS



"Inglis" Turbine Pumps are the best by actual test—our pumps are in operation from Coast to Coast and in every case are giving absolute satisfaction.

*Write us for prices*

Horizontal Belt Driven Turbine Pump Supplied  
Toronto University

**THE JOHN INGLIS CO., LIMITED**

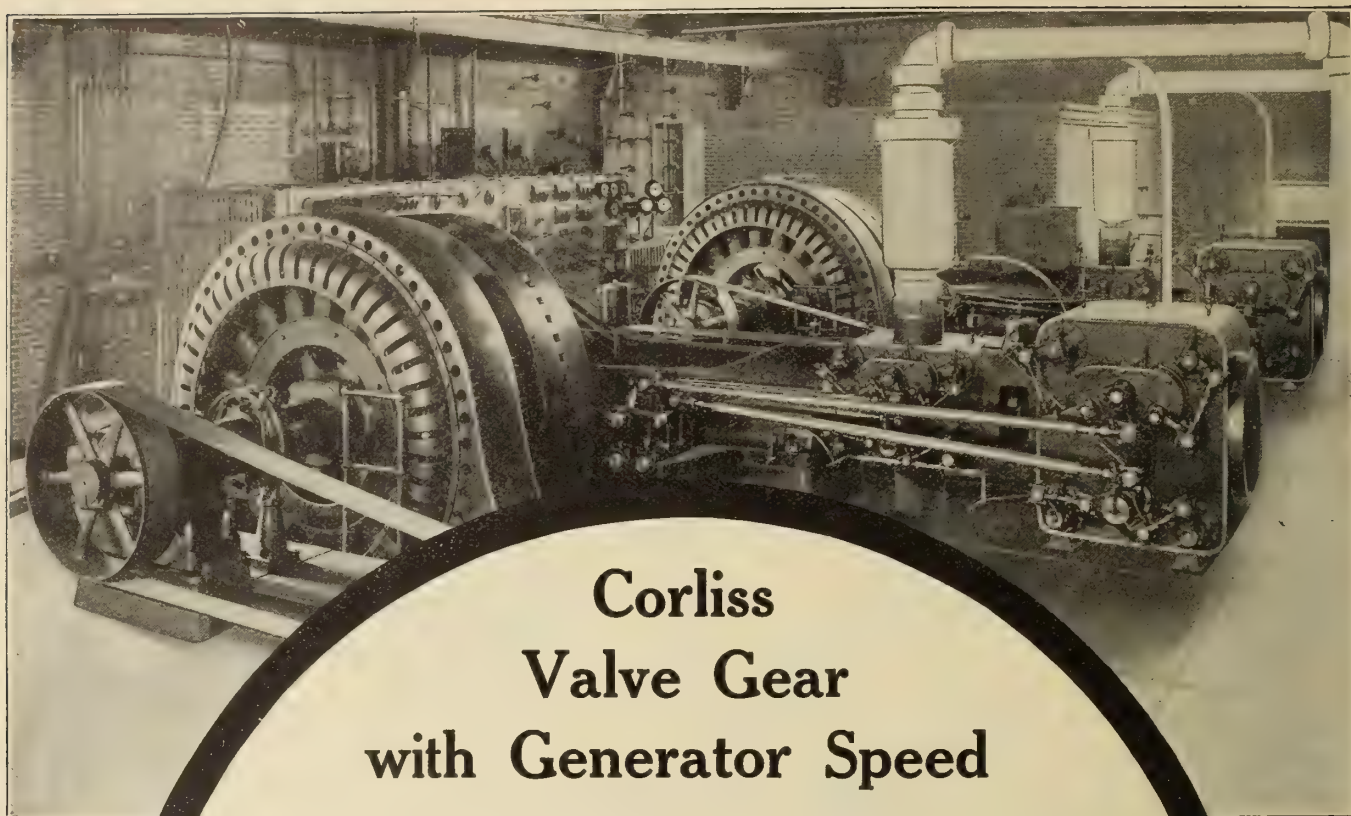
*Engineers and Boilermakers*

14 STRACHAN AVE.

TORONTO, CANADA

Montreal Office:—Room 509 Canadian Express Building





## Corliss Valve Gear with Generator Speed

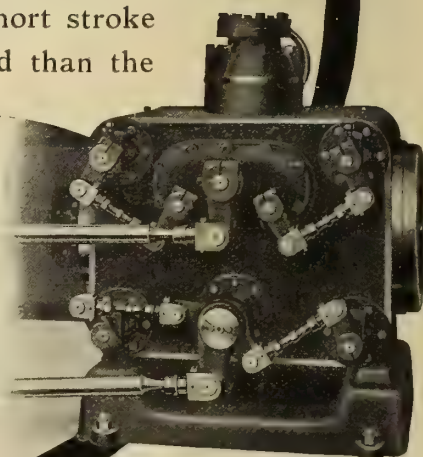
This feature distinguishes

# Robb Corliss Engines

A simplified valve gear, multiported valves, short stroke and compact frame permit a much higher speed than the ordinary form of Corliss gear.

Half as many parts to wear, no springs, no dash pots, no latches, no cams, no disengaging parts, — but Corliss steam distribution and small clearances.

Scotch Boilers  
Vertical Engines  
Horizontal Boilers  
Water Tube Boilers



## INTERNATIONAL ENGINEERING WORKS, LIMITED

FRAMINGHAM, MASS.

AMHERST, N.S.

Montreal

Toronto

Winnipeg

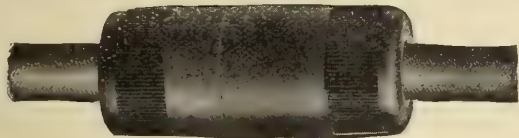
Calgary

Edmonton

Vancouver



## New Molded Insulation Cover for DOSSERT No. 4 CONNECTOR



No. 4 Insulated Connector

COST SAVING of 21% as compared with price of connector and cover heretofore supplied for small sizes of wire. Range from No. 4 to No. 14, solid or stranded.

**DOSSERT & CO.,** 242 West 41st St.,  
NEW YORK

H. B. LOGAN, PRESIDENT  
IRVING SMITH, Canadian Rep., Unity Bldg., MONTREAL



## A Text Book for Gift Makers

at any time, is our new booklet,  
"The Dainty Way to Keep House."

- † It has interested thousands in lamp socket cooking and heating appliances of Simplex Quality.
- † Your customers will be glad to receive it.

**SIMPLEX ELECTRIC HEATING CO.**

Mfrs. of Everything for Electric Heating and Cooking  
BELLEVILLE, ONT.

CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.  
SAN FRANCISCO, 612 Howard St.

# PORCELAIN

Knobs, Tubes, Cleats,  
Insulators



Prompt  
Shipments

Best  
Quality

Send for Catalogue

**Illinois Electric Porcelain Co.**  
Macomb, Ill., U. S. A.

# Drawn Steel UNILETS



IF this particular advertisement can induce you to place a trial order for "Unilets," then the object of the advertisement has been accomplished for we believe they are the most up-to-date conduit fittings on the market and will be readily adapted as your standard thereafter.

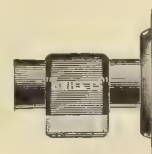
The claims we make for these fittings are so many that we will not endeavor to place them before you at this time, and the only way to prove their true value is to try them on your next job.

"Unilets" are packed in paper boxes, neatly labeled with the quantity, catalogue number, size and with an illustration of the fittings contained in the boxes.

Copy of our latest catalogue No. 7, also small booklet on "Unilets" sent upon request. Write us at once, addressing Dept. "D."

After your first trial, you will know what we mean when we say these fittings are much lighter in weight and stronger than cast-iron fittings. The reason for this is that "Unilets" are drawn from steel, are much more flexible and at the same time, allow more space for making connections, etc.

You will find in "Unilets" many points of superiority over and above other fittings. If you cannot secure your requirements through your jobber, write us and we will find a way to give you a trial of these fittings.



## APPLETON ELECTRIC COMPANY

Main Office and Factory, CHICAGO, 212-214 N. Jefferson Street

THE MAINER ELECTRIC CO., LTD.  
WINNIPEG

For sale in Canada by  
MARSHALL-WELLS CO., LTD.  
WINNIPEG

CHAPMAN AND WALKER LTD.,  
TORONTO



# Canada Wire & Cable Co., Limited, Head Office and Works TORONTO

**Bare and Insulated Electrical Wires for all purposes**  
**Electric Railway Trolley Wire and Feeder Cable**

*Sales Offices and Branch Warehouses:*

401 Lake of the Woods Bldg., MONTREAL

150 Princess Street, WINNIPEG

Macdonald Marpole Company, Limited, 427 Seymour Street, VANCOUVER

*Prompt shipments from Factory or nearest warehouse.*

## John Starr, Son & Co.

Limited

158 Granville St. - HALIFAX, N. S.

## Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,  
CONDUIT, MOULDING, SWITCHES, CUT-  
OUTS, FIXTURES, ETC., ETC.

Large Stocks - Prompt Shipments

Write Us for Low Prices

## Street Illumination

By Multiple and  
Serie

## Pemco Fixtures

**"The Practical Fixture"**

*Send for Bulletin No. 7*

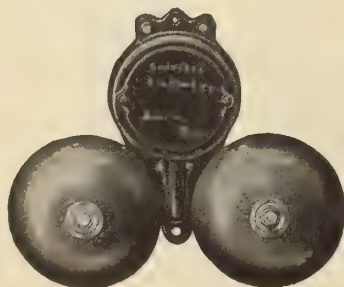
**Philadelphia Electric and  
Mfg. Company**

PHILADELPHIA, PA.

Canadian Representative

A. H. Winter Joyner, Limited

76 Bay Street, Toronto



## We Have a Bell For Every Purpose

There can be only one best and that is the Schwarze. No. 12 Common Magneto Extension for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire is all active. Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and very much louder, and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof.

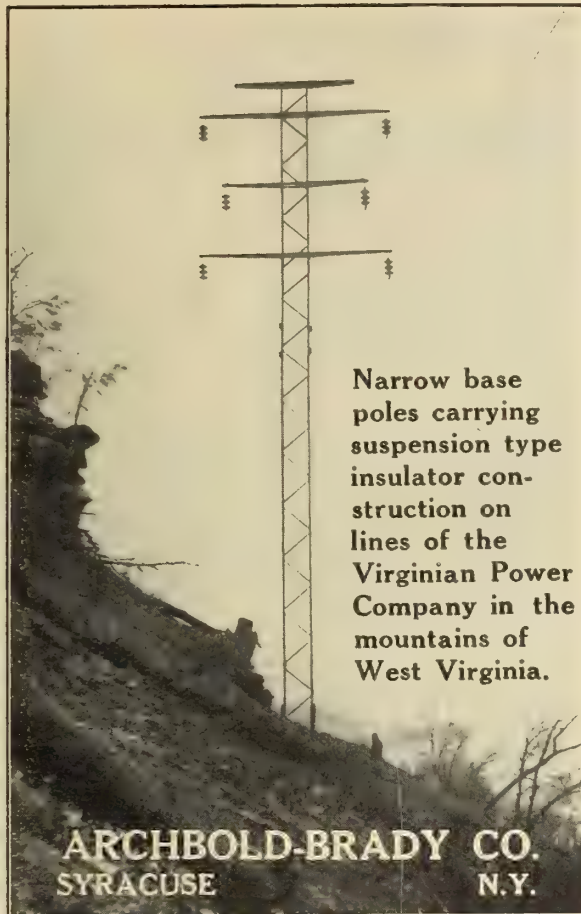
Write for catalogue.

All resistances.

**Schwarze Electric Co., Adrian, Michigan**

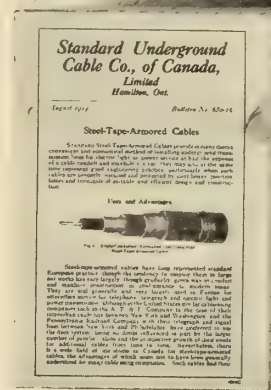
Norton Telephone Co., Canadian Agents





Narrow base  
poles carrying  
suspension type  
insulator con-  
struction on  
lines of the  
Virginian Power  
Company in the  
mountains of  
West Virginia.

**ARCHBOLD-BRADY CO.**  
SYRACUSE N.Y.



### This New Bulletin

describes the uses and advantages of steel-tape-armored cable. It also gives specification instructions for ordering and installing

### STANDARD Steel-Tape-Armored Cable

If you desire this or any of the following new bulletins write our nearest office for a copy:

- No. 200—1 Colonial Copper Clad Specifications
- No. 400—1 Weatherproof Wire
- No. 680—1 Steel-Tape-Armored Cable
- No. 700—1 D.O.A. (Davis Open Air) Terminals
- No. 710—1 D.S. (Davis Station) Terminals

**Standard Underground Cable Company  
of Canada, Limited**

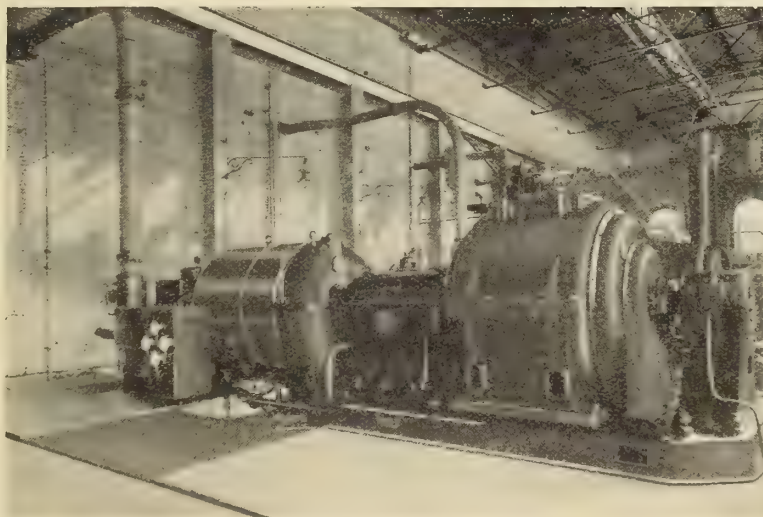
Hamilton, Ont.

Montreal, Que. Winnipeg, Man. Seattle, Wash.

# CANADIAN VICKERS LIMITED

## Motors and Generators of all Types

Complete  
Equipments for  
the electrical  
lighting and  
driving of ma-  
chine shops,  
factories, etc.



Rotary  
Convertors  
Patent Auto-  
matic Revers-  
ing Drive for  
Reciprocating  
Machine Tools.

Vickers-Belliss Three Phase Turbo Alternator, 2500 kw., 2300 volts, 1800 r. p. m.  
as supplied to the City of Calgary.

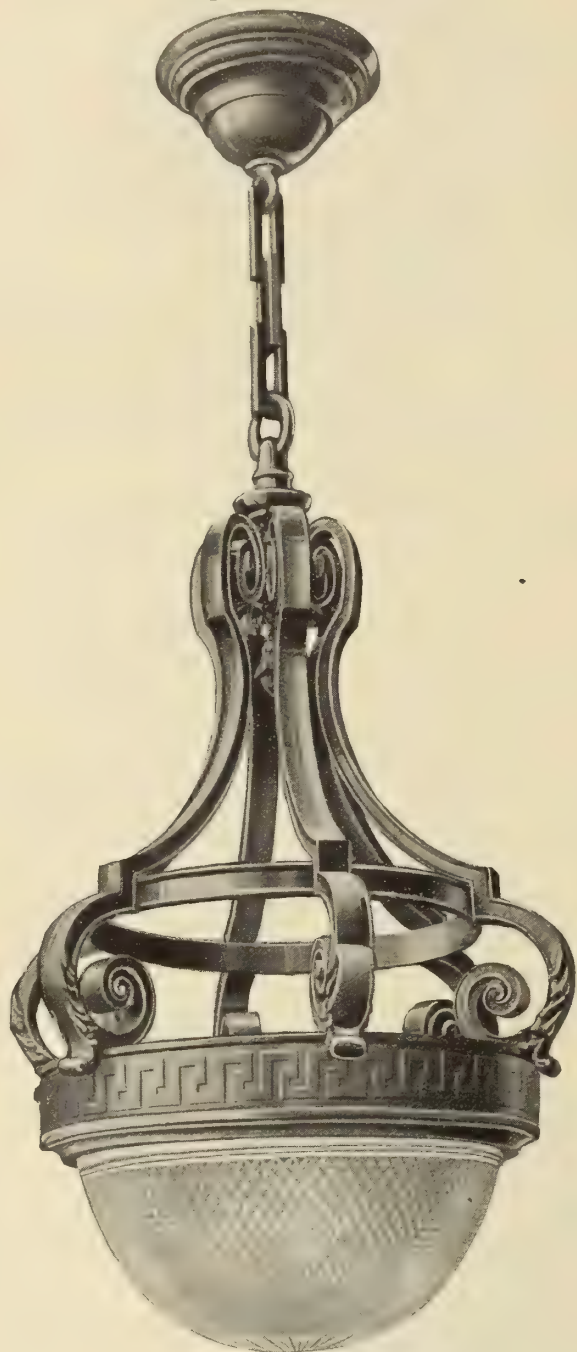
Head Office for Canada: Lewis Building, Montreal  
Mr. J. F. I. Thomas (Representative)

Works:  
River Don Works, Sheffield, England



## Tallman Electric Fixtures

*They're different*



We make an exclusive line of Fixtures for House, Bank, Church and Office Lighting.

***Our Designs are Original.***

We shall be pleased to submit special designs on application.

MANUFACTURED BY THE

**Tallman Brass & Metal Co.**  
HAMILTON, ONT.

# Special Prices

— ON —

## Electrical Books

**The Following Books are Offered Subject to Previous Sale**

**The Steam Turbine**, by Robert M. Neilson. Published in 1903 by Longmans, Green & Co., 294 pages, illustrated. Price \$1.00.

**Telegraphy**, by Sir W. H. Preece, K.C.B., and Sir J. Sivewright, M.A. Published in 1905 by Longmans, Green & Co., 504 pages. Price \$1.00.

**Electro-Dynamos**, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company, 298 pages. Price 50c.

**Electrical Engineering**, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price \$3.00.

**Radiation, Light & Illumination**, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price \$2.50.

**Electric Motors**, by Crocker & Arndt. Published in 1910 by D. Van Nostrand & Company. Price \$2.00.

**Short Course in Testing Machinery**, by Morecroft and Hehrs. Published in 1911 by D. Van Nostrand & Company. Price \$1.

**Dynamo Electrical Machinery**, by Sheldon & Hausman. Published in 1910 by D. Van Nostrand & Company. Price \$1.50.

**Electricity—Experimentally and Practically Applied**, by Ashe. Published in 1910 by D. Van Nostrand & Co. Price \$1.00.

**The Dynamo (2 volumes)**, by Hawkins & Wallis. Published in 1909 by Whittaker & Company. Price \$4.00.

**Steam Turbines**, by Kennedy. Published in 1910 by Whittaker & Company. Price \$1.00.

**Dynamo-Electric Machinery**, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price \$1.00.

**Telephone Law**, by A. H. McMillan. Published in 1908 by McGraw Hill Publishing Company. 332 pages. Price \$1.50.

**Practical Methods of Electro-Chemistry**, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price \$1.00.

**Treatise on Thermodynamics**, by Dr. Max. Planck. Published in 1903. 272 pages. Price \$1.00.

**Text-Book of Electrochemistry**, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price \$1.00.

**Electrical News**

347 Adelaide St. West

Toronto, Ontario





## World's Highest Building

equipped with

## World's Best Vacuum Cleaners

They are Sturtevants and we want you to be the selling agents for it in your community.

# Sturtevant

(REG. CAN. PAT. OFF.)

## Vacuum Cleaners

have a large sale in the United States under the name of Western-Electric-Sturtevant. They form a complete range—seven sizes of portables and ten sizes of stationaries.

You need not unload upon customers machines unsuited to their work. No matter what the work there's a Sturtevant to do it.

Like all Sturtevant apparatus, the machine is made to run—it has the two great essentials, simplicity and durability—It runs day in and day out for years.

IT IS BUILT WITH A CONSCIENCE.  
SOLD WITH A GUARANTEE.

Will you accept the agency for your town?

**B. F. Sturtevant Co. of Canada**

Limited

Head Office and Works, GALT, ONT.

# Ornamental Lighting Standards

In this electrical age most cities are installing ornamental street lighting standards. A well lighted town is always a busy town and is destined to grow and prosper.

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During the past few months we have supplied ornamental lighting standards for the following places:—

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Belleville, Ontario

*Write our lighting pole department  
for full information.*

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Company, Limited

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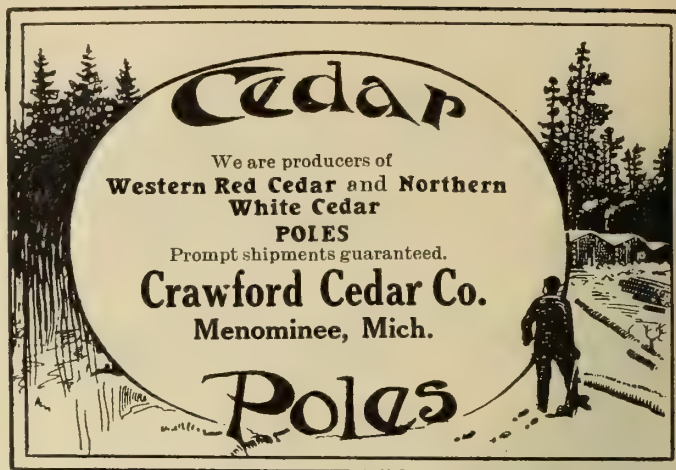


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will double or treble the ordinary life of your line at a small cost. It will pay you to investigate. Ask for full information and our special folder.

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"Good Poles Quick"  
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**Cedar**

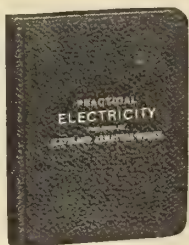
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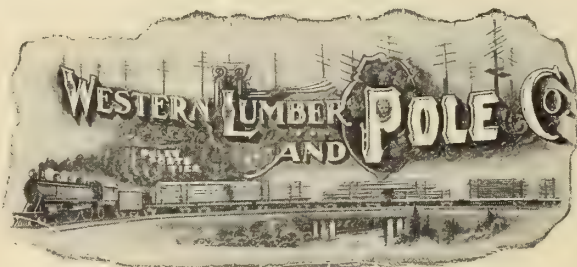
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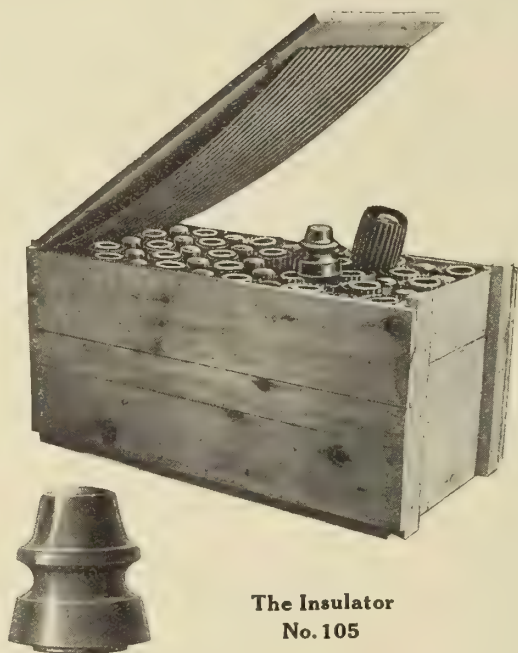
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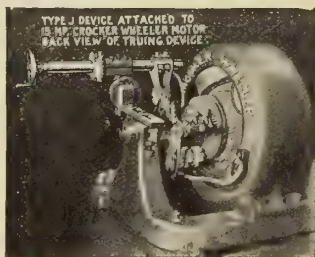
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Operates without removing armature. No shut down of motor or generator.

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No portable slide-rest with the danger of the tool digging into the commutator and numerous other chances of damage to the commutator or armature which are all overcome with this machine.



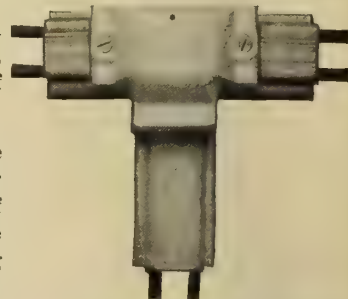
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A real time saver which means a Money Saver, making the best class of work.

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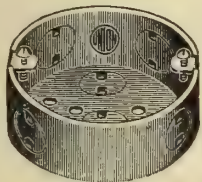
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## They meet every need of the Contractor

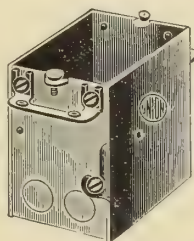


No. 103 Box

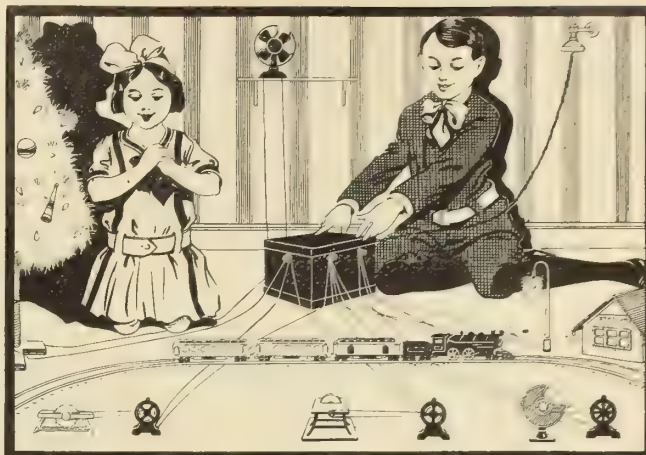
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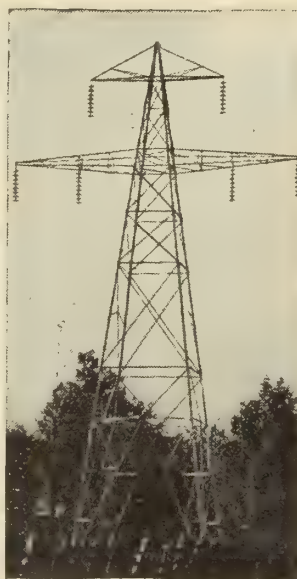
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Do away with nails, staples, tape and other make-shift methods of holding flexible tubing



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These clamps prevent any displacement of the tubing after the job has been inspected.

**Type A**—For combination gas and electric outlets. The center opening for the gas pipe, the outside opening for tubing.

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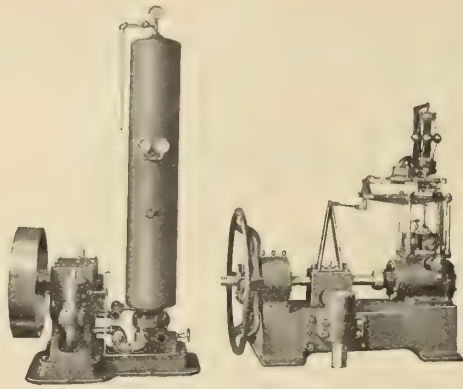
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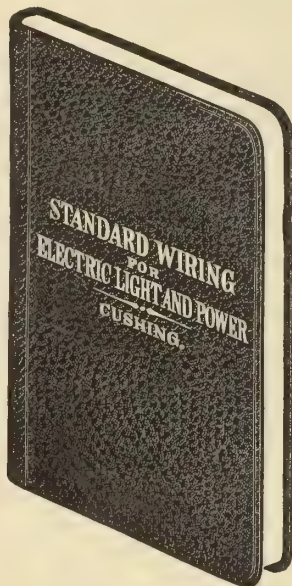
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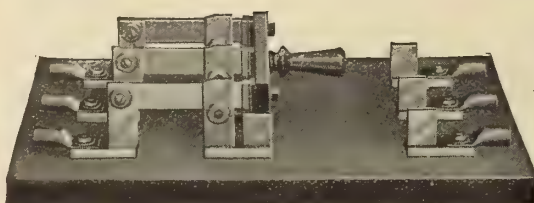
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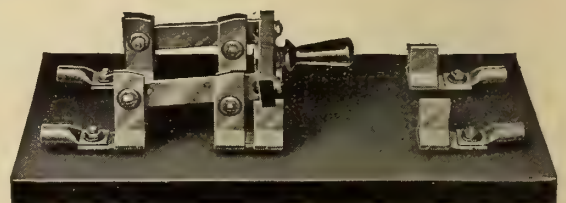
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Type "A" See catalog, pages 6 to 11.

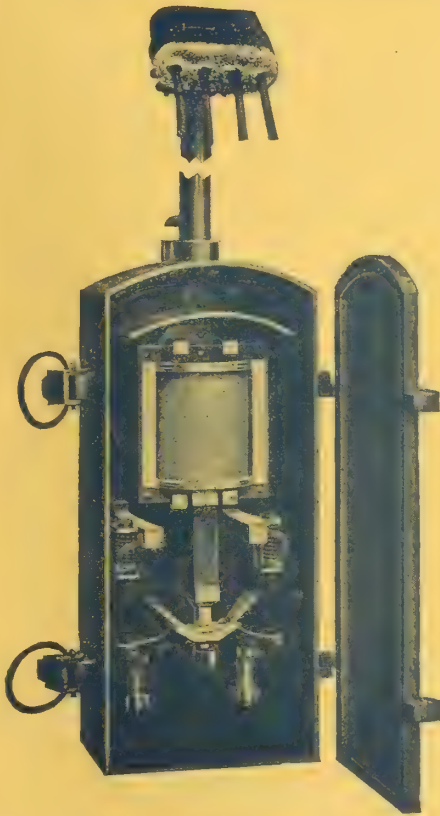
FRANK ADAM ELECTRIC COMPANY

Type "F" See catalog, pages 16 to 21

ST. LOUIS, Missouri, U. S. A.



## Solenoid Switches for Remote Control of Street Lights



This cut shows our Type 17 H.E.P. Solenoid switch which was adopted by the Hydro-Electric Commission of the Province of Ontario and used by them in a large number of Ontario towns.

Orders are received from all the Provinces.

This switch is no experiment. The fact that it has been adopted by the Hydro-Electric is proof of its success.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

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*If you want complete, quick service, wire us.*

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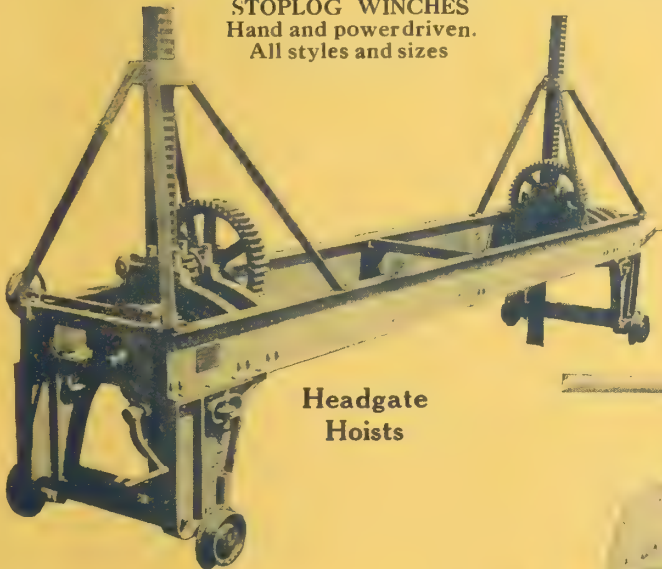
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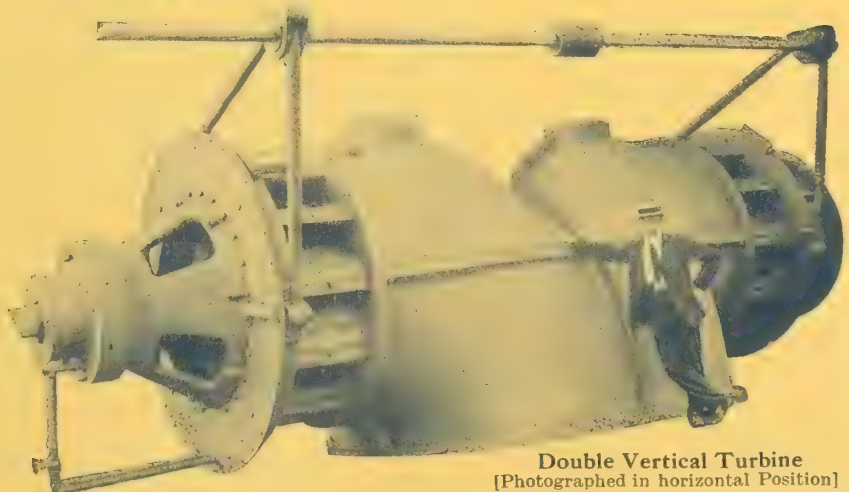


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The line, at present, consists of a single box containing a double pole, 30 ampere, 125 volt combination switch and cutout, for Edison plug fuses; a double compartment box in one side of which is mounted the same type of switch and cutout as in the single box and in the other side a two-wire, double branch Edison plug cut out; also a double compartment box with a main line switch and cutout in one side and two two-wire double branch cutouts of the Edison plug type in the other side.

All sizes furnished with switches and cutouts mounted in boxes ready to install.

Every man connected with the electrical industry in Canada should know about the "Square D" line.

Write for Bulletin W-31—it gives complete detailed information.

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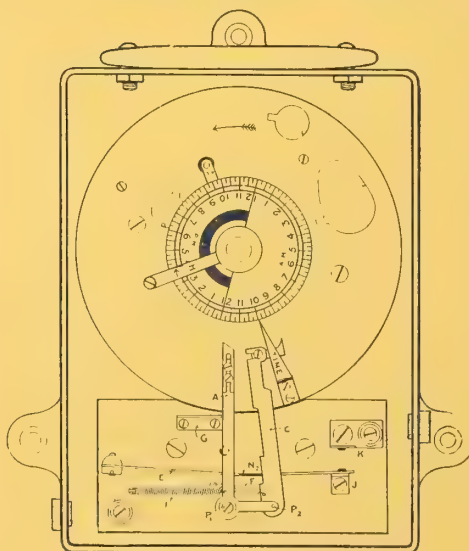
Cat. No. 2001  
Branch

circuit compartment closed, switch compartment open, showing switch in "locked off" position. When switch is in above position if cover of switch compartment is closed and locked or sealed it is impossible to throw the switch on.



Cat. No. 5211-E  
Cover closed and locked, Switch in "locked off" position.

## THE VENNER TIME SWITCH



**NEVER FAILS  
TO PERFORM ITS WORK**

**A high-grade instrument in every way—at the same price you have been paying for inferior makes.**

The Venner is no ordinary time-switch. It is a high grade instrument in every respect, designed and built to perform its functions with never-failing and unerring accuracy.

Accompanying illustration shows a line drawing of the principal mechanism of our type "B" time switch.

Wherever you need a time-switch, you need a Venner.

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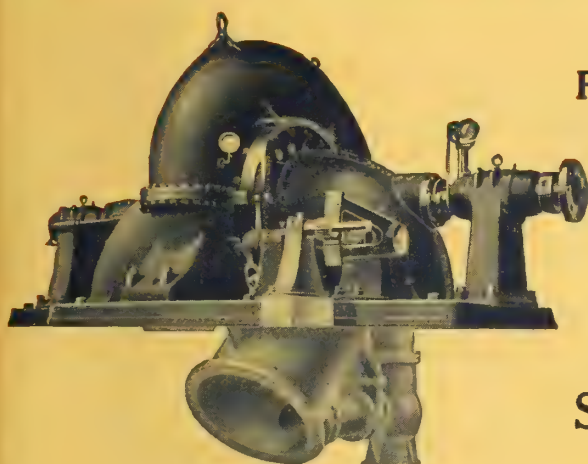
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# Electrical News

Generation, Transmission and Application of Electricity



5250 Horse Power 275 Feet Head

## 90 % EFFICIENCY From SMITH HYDRAULIC TURBINES

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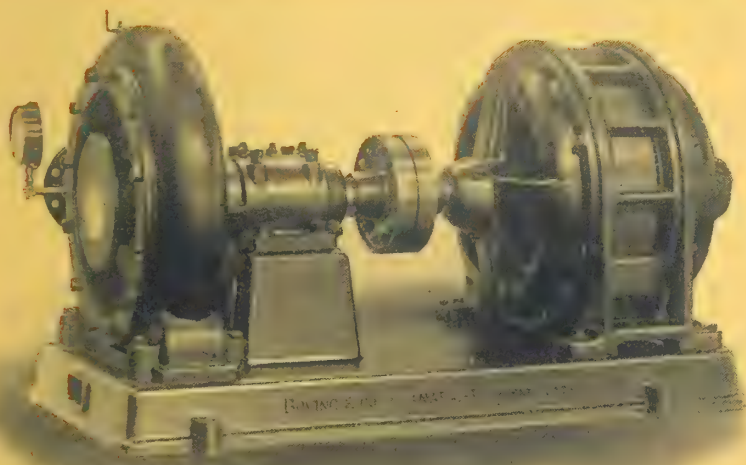
These tests showing efficiencies from 89% to over 90%.

We design and build turbines for heads from 5 feet to 650 feet.

*Send for Bulletin N*

**S. Morgan Smith Co., York, Pa.**

Branch Offices: 176 Federal St., BOSTON, MASS.  
614 American Trust Bldg., CHICAGO



1000 Gallon Pump as supplied to the Cedars Rapids Manufacturing & Power Co.

## MADE IN CANADA

**High Class Turbo  
Pumps for  
Waterworks  
Service.**

*Send for fully illustrated  
Catalogues to*

## Boving & Co. of Canada, Limited

Head Office: 164 Bay St., TORONTO

Factory—Lindsay, Ont.

94 Grafton Ave.  
Moose Jaw, Sask.

London Bldgs.  
Vancouver, B.C.

Mexico City    Wellington    Cairo    London, Eng.    Tokyo    Johannesburg    Rio De Janeiro



# MADE IN CANADA

## *Packard* METERS

### *Accurate Recorders of Electric Currents*

The achievements of Packard Meters in the past fourteen years firmly establishes the truth of this statement and recent re-inspections of the Government furnishes the federal truth.

With every Packard Meter goes the reputation of a firm whose name in the past has become a by-word for meters—PACKARD.

Packard Meter service means a reliable meter service—what is it worth to you to know you can depend on your meters? Isn't it worth an investigation?

*Let us send you more detailed information.*

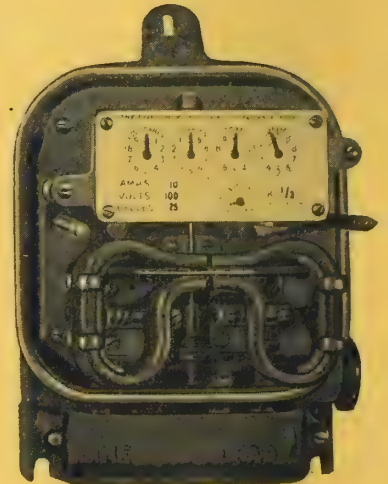
The **Packard Electric Co., Ltd.**

Factory at St. Catharines, Ont.

General Sales Office, N. W. Office and Warerooms  
Traders Bank Bldg., TORONTO WINNIPEG

LARGE STOCKS CARRIED AT

St. Catharines and Winnipeg; St. John Railway Co., St. John, N. B.;  
General Supplies, Limited, Calgary, Alta.;  
Rudel-Belnap Machinery Co. Canadian Express Building, Montreal, Que.



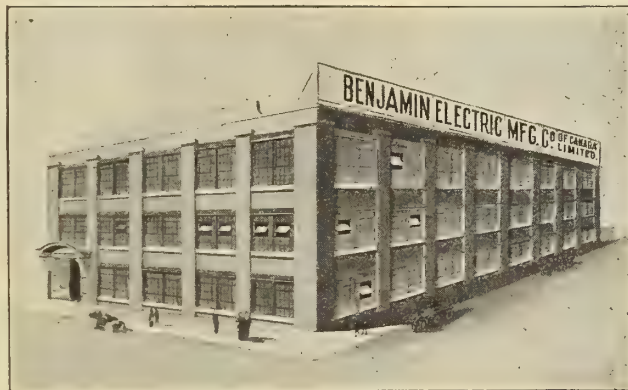


**“MADE IN CANADA”  
WILL SURELY MAKE CANADA**

## **BENJAMIN PRODUCTS**

*Are Made in Canada—By Canadian Labor—  
From Canadian Material*

**BUY IN YOUR OWN COUNTRY—BUY “MADE IN CANADA” GOODS**



**BENJAMIN CANADIAN FACTORY**

SOCKETS  
WIRING DEVICES  
REFLECTORS  
STREET FIXTURES  
ATTACHMENT PLUGS  
PORTABLE FIXTURES

ROSETTES  
FACTORY FIXTURES  
WIRELESS CLUSTERS  
KNIFE SWITCHES  
NITRO FIXTURES  
SPECIAL FIXTURES

**“BUY BENJAMIN”  
MADE IN CANADA  
FROM YOUR JOBBER**

*Write for Catalog C-21—Bulletin 223—Bulletin 30-S*

**Benjamin Electric Mfg. Co.**  
**of Canada, Limited**

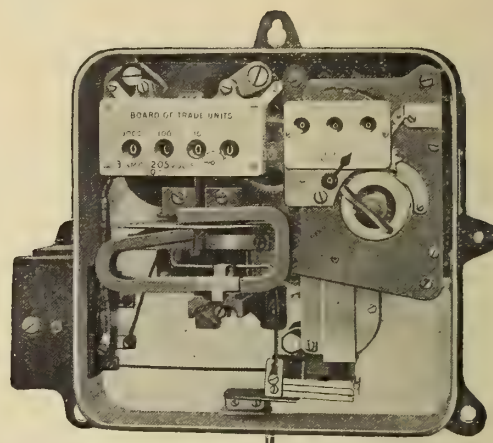
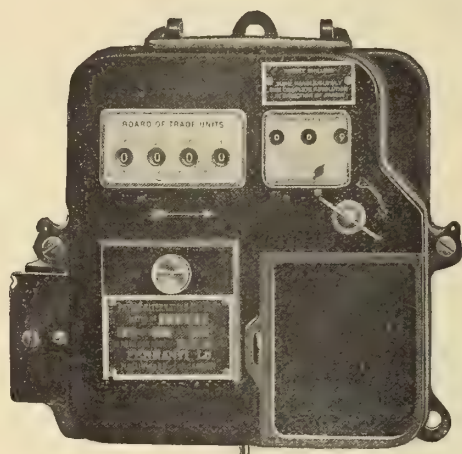
**11 to 17 CHARLOTTE ST.**

**TORONTO**



# FERRANTI

## PREPAYMENT METERS



Simple

Accurate

Low Priced

Obviate Bad Debts

Fool and Fraud Proof

Knife Blade Switch; NO MERCURY CONTACTS

*Write for our new descriptive leaflet No. T 10*

**FERRANTI ELECTRICAL COMPANY OF CANADA  
LIMITED**

90 Sherbourne St.  
TORONTO

704 Unit. Bldg.  
MONTREAL

Farmer's Advocate Bldg.  
WINNIPEG



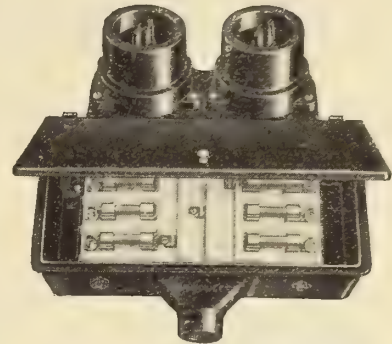
# New Condulets—P G and Z G Series



Type PG, Showing Snap Switch with Protective Cover Mounted.

Especially designed to take Snap Switches with Protective Covers.

ZG Series Condulets Also Take Cut-outs.



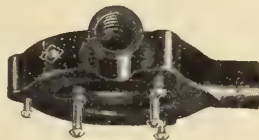
Type ZGU, Showing Snap Switches with Protective Covers and 3-Wire Cut-out Mounted.



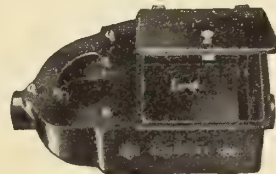
Type PGC.



Type PG.



Type PGL.



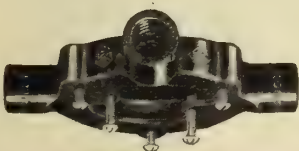
Type ZGC.



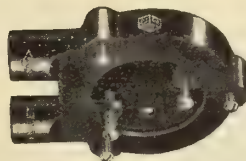
Type PGCA.



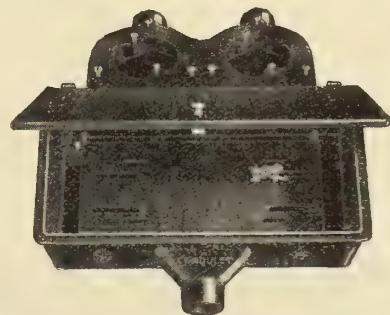
Type PGB.



Type PGT.



Type PGG.



Type ZGU.

*Order from your dealer. If he does not stock them, write us.  
New Bulletin No. 1000A sent upon request.*



**Crouse-Hinds Co. of Canada, Limited**

Main Office and Works:

**Toronto, Ontario, Canada**





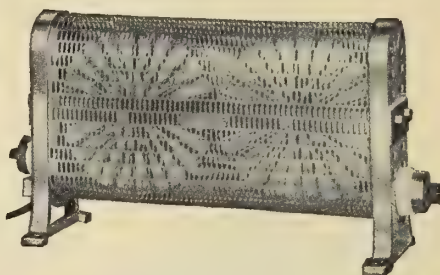
# Radiators For Every Requirement

## "ECONOMIC" TWO AND THREE DISK TYPES

### THREE-GLOWER

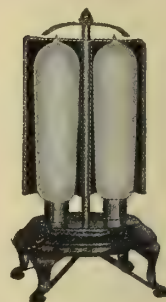


Cat. No. 139320  
18 in. by 17 in. by 8 in.  
With three 250 or 500 Watt Bulbs.  
Solid cast frame with polished copper reflector.



Made in capacities of 1000, 1400 and 2100 watts,  
with heat control by indicating switches.

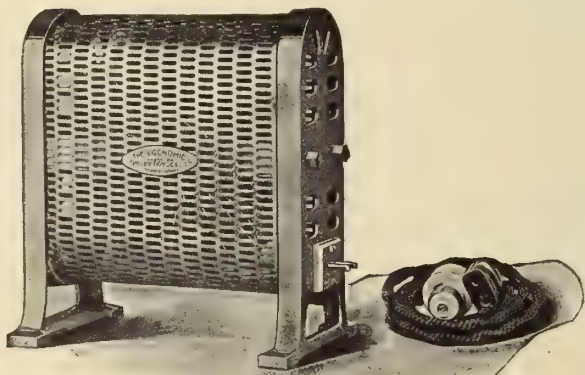
### TWIN-GLOWER



Cat. No. 78871  
Size 16 in. by 8 in. by 8 in.  
With two 250 Watt Bulbs  
Nickel frame with polished copper reflector.  
A convenient and popular portable radiator for small room heating.



## "ECONOMIC" SINGLE DISK



Cat. No. 6417½. 660 Watts

An efficient heater for use from the ordinary socket.

## SUSPENDED COIL HEATERS



Type A-51 as shown. Type A-26, without switch.  
Size 16 in. by 18½ in. by 6½ in.  
Supplied in capacities ranging from 1 kw. to 5 kw.  
The larger capacities are especially adaptable for sub-station heating.

# CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: Toronto. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert



# An Unusually Attractive Christmas Proposition

THERE is no gift which makes such a strong appeal to the housewife as something which fits her needs so well that she appreciates it every day of the year.

## THE **EUREKA** Electric Vacuum Cleaner

is a saver of work and time. It answers the most crying need of every housewife. It makes her home life more bright and cheerful. As a gift it will spread the spirit of Christmas over a long period of time.

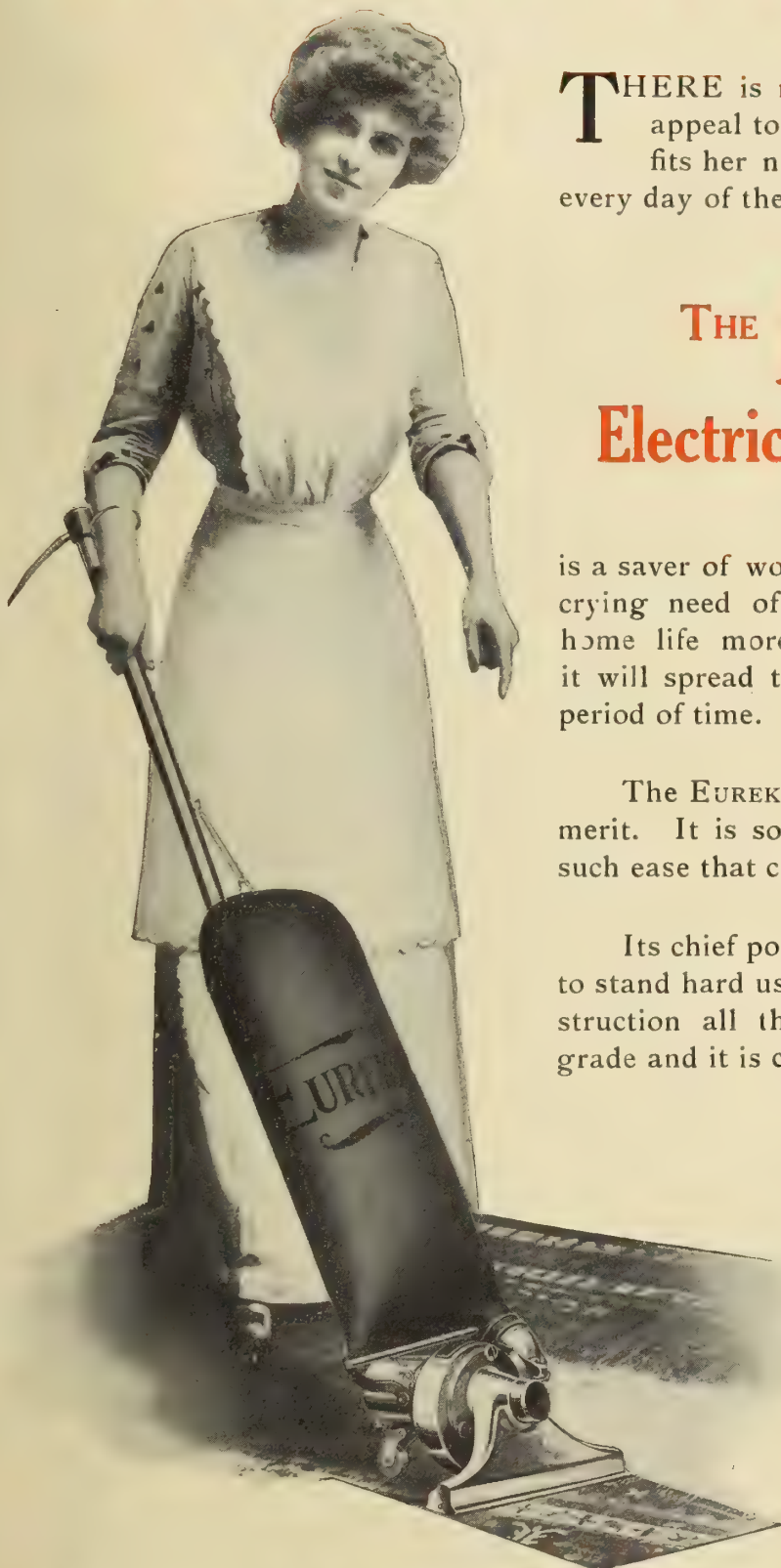
The EUREKA is an Electric cleaner of unusual merit. It is so simple to operate and runs with such ease that cleaning is no effort at all.

Its chief point of superiority lies in its ability to stand hard usage and give long service. Its construction all the way through is of the highest grade and it is covered by a rigid guarantee.

**The Eureka is the  
machine you can  
SELL — at a big  
profit.**

*Write us for our illustrated  
folder and dealer's  
proposition.*

**Onward Manufacturing Co., Berlin, Ont.**





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**The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers**



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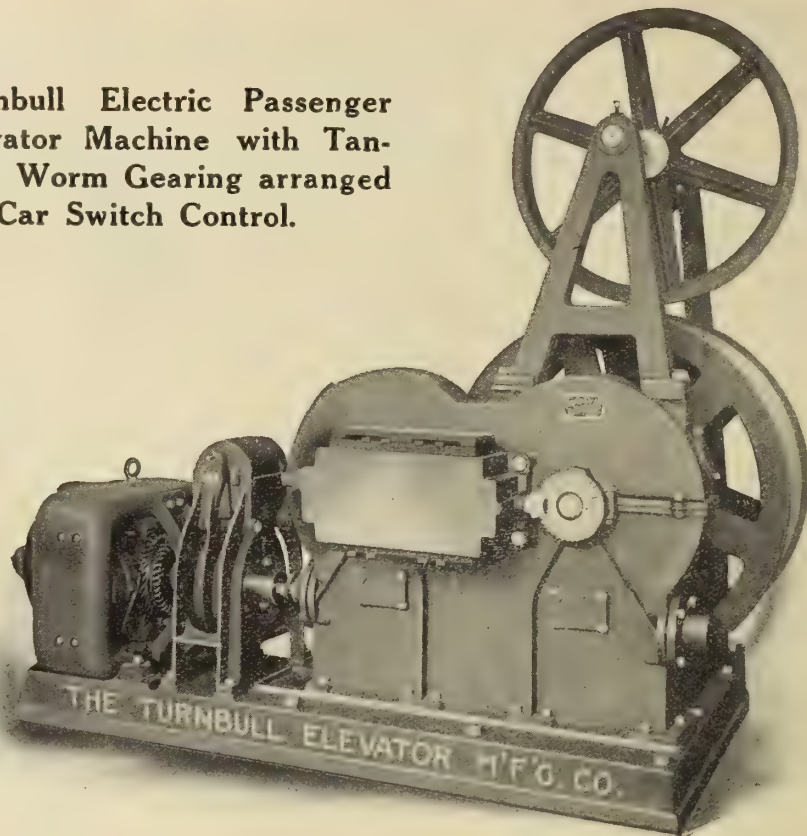


Royal Bank Bldg., Toronto. A "GALVADUCT" Building.

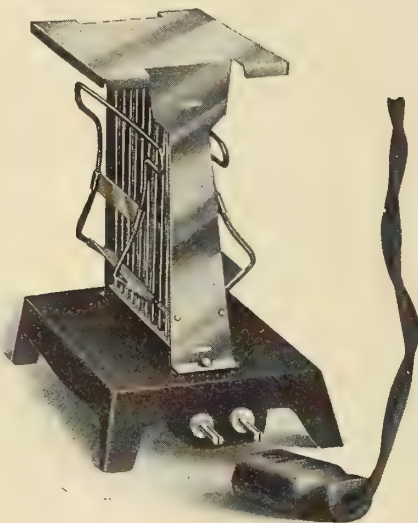
**CONDUITS COMPANY Limited.**  
**Toronto - Montreal**



Turnbull Electric Passenger Elevator Machine with Tandem Worm Gearing arranged for Car Switch Control.



Write at once for **THE AUTOSIGN AGENCY** in your district



**Cadillac Upright Toaster**

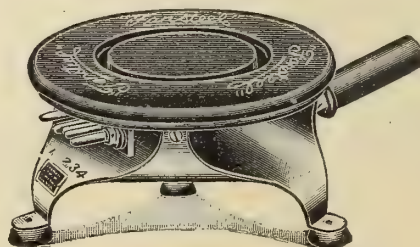
**Two-In-One**

four way heat

**"Fansteel" Disc-Stove**

The **Autosign** has a distinctive beauty obtained by the contrast of an exquisite white glass plate mounted in a polished ebony frame. Pure rubber letters are fitted in grooves over which is drawn a plain glass cover. This high class electric interchangeable sign, **made in any size**, is the only one of its kind that is "made in Canada."

It is low priced, and to any dealer who is prepared to push the **Autosign** we have a mighty good proposition.



Two separate discs which can be heated together, or independently of each other. Inner disc is 3 inches in diameter, outer disc 1 1/4 inches, giving a total heating surface of 6 inches.

**ROPER, CLARKE & COMPANY, LIMITED**

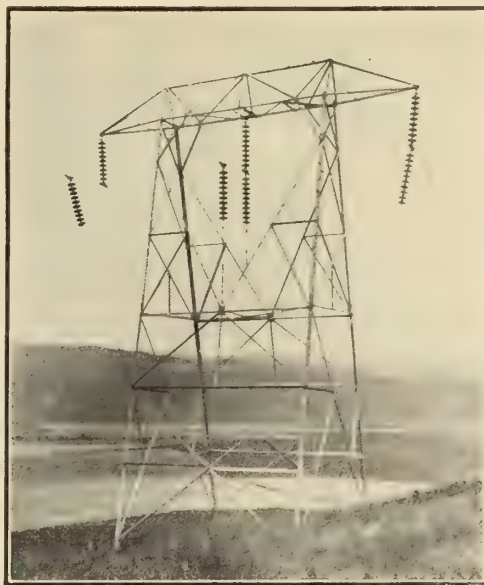
Suite 422 Coristine Building, Montreal  
Engineers, Importers and Manufacturers Agents



# 150,000 VOLTS

ON THE LINE WIRE WITHOUT CORONA LOSS WHEN THE CONDUCTORS ARE OF ALUMINIUM.

WE HAVE JUST GOTTEN OUT A NEW EDITION OF OUR OVERHEAD POWER BOOKLET. HAVE YOU HAD YOUR COPY? IF NOT, A POST CARD WILL BRING IT.



**THE BRITISH ALUMINIUM CO., LIMITED**  
OF LONDON, ENGLAND  
60 WEST FRONT STREET, TORONTO

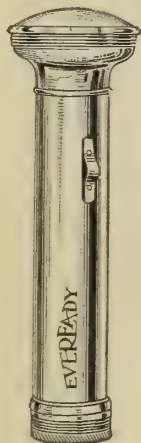
## EVEREADY

If you use or handle flashlights insist upon the genuine  
EVEREADY with EVEREADY Tungsten (trade mark)  
batteries and EVEREADY Mazda lamps.

**"Canadian Made for Canadian Trade"**

*A post card request will bring new catalog B225.*

**This is Your Protection.**



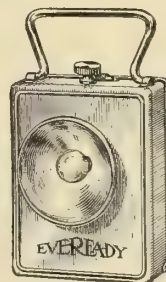
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No. 6991

### GUARANTEE

WE GUARANTEE THIS  
EVEREADY TUNGSTEN BATTERY TO GIVE 8 TO 12 HOURS  
SERVICE ONLY WHEN USED  
WITH A 3.8 VOLT EVEREADY  
MAZDA BULB, AND THAT IT  
WILL NOT DEPRECIATE  
MORE THAN 10% IN 6  
MONTHS WHEN NOT IN  
SERVICE AND SEAL IS  
UNBROKEN



No. 4706



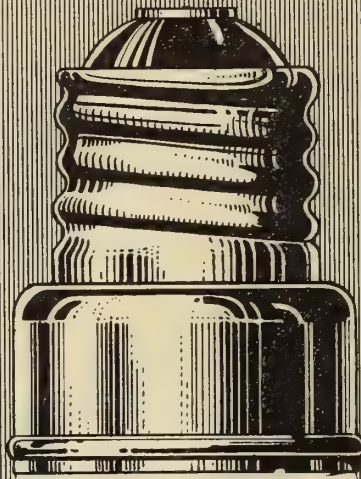
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**Canadian Ever Ready Works**

of Canadian National Carbon Company, Limited

**TORONTO, ONTARIO**





# LAMPS

that are made right—

that give a brilliant white  
light—three times more  
than carbons—

that are made in all standard  
shapes and sizes—

that are made in Canada—are

## *Northern Light* *Mazda Lamps*

They build up dealers' reputations.

They make satisfied customers.

They make cash register results buck up.

They make friends all round.

Our nearest house has a complete stock of both  
lamps and selling helps. Write them by next mail.

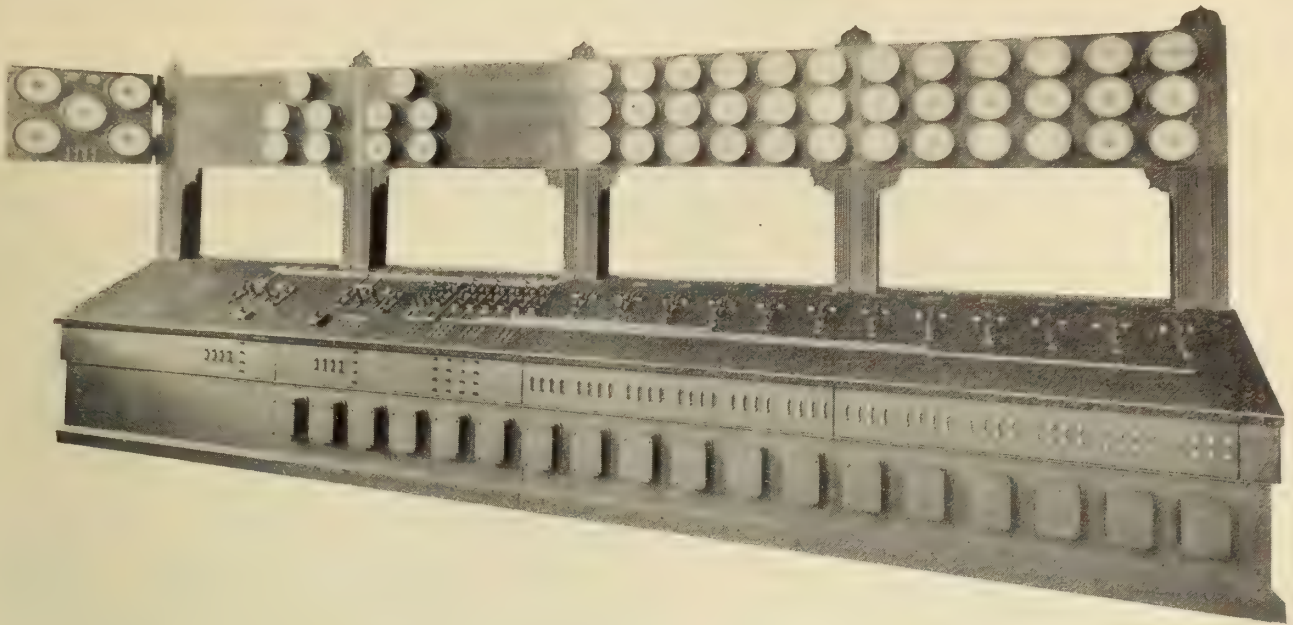
*Northern Electric Company*  
LIMITED

MONTREAL  
HALIFAX  
TORONTO

WINNIPEG  
REGINA  
CALGARY

EDMONTON  
VANCOUVER  
VICTORIA





Bench Board built for the City of Saskatoon



Control Pedestal built  
for City of Winnipeg

## QUALITY FIRST!

¶ Quality should never be sacrificed for price; neither is it good business to award a switchboard contract before we have been consulted.

¶ The majority of big switchboard contracts that have been entrusted to us have not been awarded on a price basis alone, but rather, because of our exceptional engineering and manufacturing facilities, *quality* has invariably been the first and determining factor.

*Northern Electric Company*  
LIMITED

MONTREAL

HALIFAX

TORONTO

WINNIPEG

REGINA

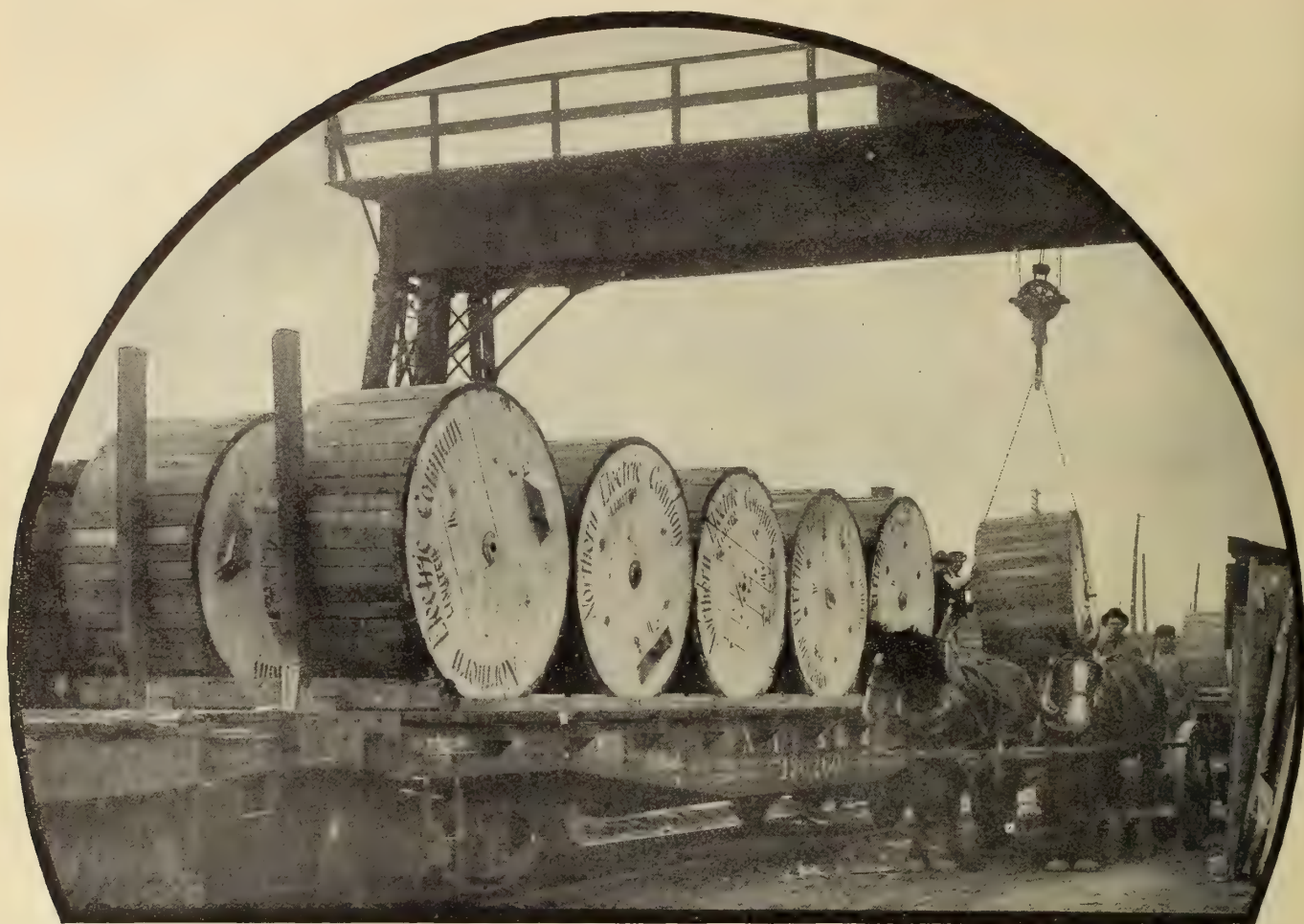
CALGARY

EDMONTON

VANCOUVER

VICTORIA





Seventeen Car Loads of  
*Northern Electric*  
 High-Tension, Lead-Covered, Paper-Insulated  
**POWER CABLES**  
 for this single order.

- ¶ Big business gravitates to those who can do big things efficiently.
- ¶ That's why the largest users of wires and cables place their orders with Northern Electric Company, Limited.
- ¶ One customer required 17 carloads of Northern Electric Power Cable like the one illustrated for their initial installation.
- ¶ It will pay you to place your orders with the Company that has earned the confidence of Central Station men and prominent engineers throughout the whole Dominion.

*Northern Electric Company*  
 LIMITED

MONTREAL  
 CALGARY

HALIFAX  
 EDMONTON

TORONTO  
 VANCOUVER

WINNIPEG  
 VICTORIA

REGINA



*The Lamp that is Always Reliable*

## THE "CONDOR" LAMP

The Lamp that is HIGH in Quality  
—but LOW in Price. It is a Money-  
maker to you Mr. Dealer—why not get  
our prices?

*Every Lamp is Guaranteed*

---

Special Christmas Shipments of

## FLASHLIGHTS

have just arrived

These comprise a large range of the latest novelties.  
Get our prices on our Special Christmas Assortments  
for immediate delivery.

---

---

*Mail Orders Given Special Attention  
and shipped the day order is received.*

---

---

## C. H. BASTERS & COMPANY

22 College Street

TORONTO, ONTARIO





### PHANTOM LOADS

Portable and Laboratory Loads

The best that can be made.

Type B shown in cut.

Send for bulletin 19

**THE STATES CO.,** 15 New Park Ave  
HARTFORD, CONN.

### Forward:

## Canadian Manufacturer—

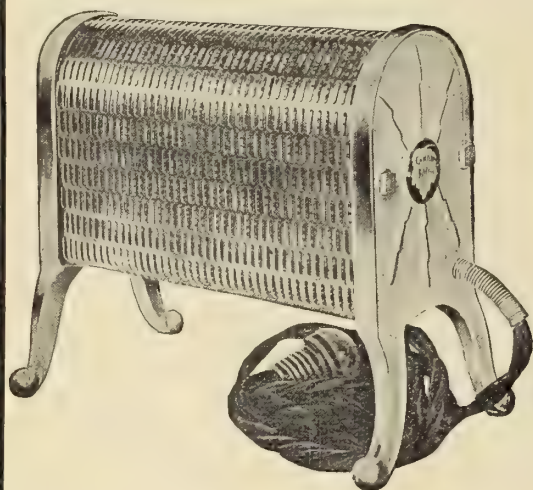
How are you preparing to sell more goods in Western Canada, taking advantage of the increased popularity of home manufactures?

Strengthen your firing line with allies familiar with the territory

With divisional headquarters in Winnipeg, Regina and Edmonton, our position is good to capture business for saleable lines.

We can represent a few more factories in a competent, aggressive manner.

**HOUSTON & CO., LIMITED**  
12-13 Cumberland Bldg. - WINNIPEG  
Post Office Box 773



### Portable Type Air Warmer

A neat, compact, portable Air Warmer, specially designed for Fall and Spring months, as an efficient heater for ordinary sized rooms and as an auxiliary for isolated rooms during severe winter weather. Retail at \$6 00—A sure sales puller.



Trade Mark

A Pair of  
"Canadian Beauties"

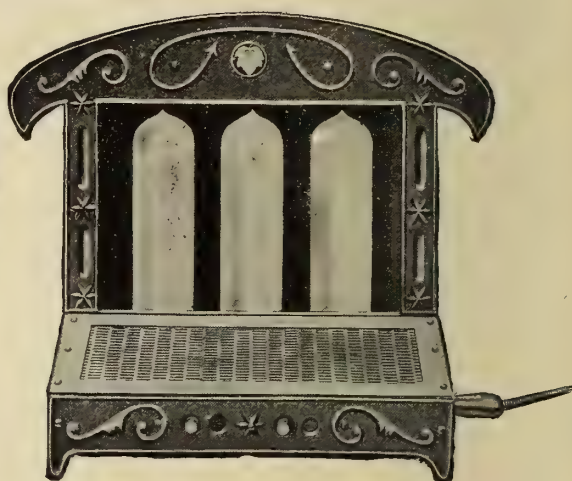
### Power Companies

Increase your load and sales by ordering a stock of these for the Xmas trade.

Electricians and Contractors increase your sales likewise by stocking and demonstrating these goods.

Support Canadian workmen by selling only—

"MADE IN CANADA GOODS."



### Portable Type Luminous Radiator and Foot Warmer Combined

The "Canadian Beauty" above illustrated is a distinct advantage over other makes inasmuch as there is a foot-warmer attached, heated by a separate unit which adds to the utility of the Radiator.

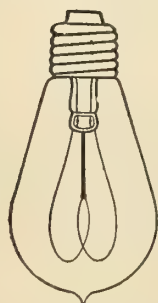
Retail price, including 10 feet of cord and lamps, only \$18.00.

Lamps and Footwarmer are operated by separate switches.

A demonstration of this Radiator to a prospective buyer gets him every time.

Manufactured and Sold Exclusively by

**Renfrew Electric Mfg. Company, Limited**  
RENFREW, ONTARIO, CANADA



## NEW PRICES

# Tungsten and Carbon Lamps

Send for Bulletin "K"



**VOLT ELECTRIC COMPANY, LIMITED**

37-41 Britain Street, TORONTO, ONT.



## High Grade Electric Fixtures

Fixture Parts

Pans

Loops

Chain

Canopies

Etc.

Send us your  
next order

We can  
save you  
money



**H. W. KNIGHT & BRO.**

TORONTO, ONT.

It Will Pay You to Use

## Frink and J-M Linolite Systems of Lighting



Main Staircase, Lipman & Wolfe Co.,  
Portland, Ore.

Because the even, glareless, brilliant light which they give wins the approval of your clients. Stores, churches, theatres, banks, etc., by the thousands have selected these systems (which are adapted for either J-M Linolite or Standard base lamps) because of their excellent qualities. Use them for your next work. As a contractor you will clear a good profit. As an engineer you will know that you have provided an illumination of surpassing beauty; one which not only reflects credit on you but which serves as your permanent advertisement and enables you to secure more business from satisfied customers.

WRITE FOR CATALOG AND PRICES TODAY.



Toronto

**THE CANADIAN**

**H. W. JOHNS-MANVILLE CO., LIMITED**

Sole Selling Agents for Frink Products

Montreal

Winnipeg

Vancouver

2718



## NICKEL

Shot, Ingots (3 sizes)

Electrolytic (99.80% Ni.)

Wire, Rods and Sheets

Metallic Nickel of our production is Prime Metal for manufacture of Nickel Steel, German Silver, Anodes, and for all alloy purposes.

Malleable Nickel of our production is successfully rolled and drawn as sheets, rods, strip stock and wire. A recent development is its use as filament supports in the new nitrogen filled Tungsten Light.

**MONEL  
METAL**

Produced in rods, flats and shot for castings. Also produced as sheets, wire and strip stock.

Send your inquiries direct to us

**The International Nickel Co.**

43 Exchange Place, New York

## UNIFORMITY!

in mechanical strength, wearing quality, firmness of texture and lubricating quality, **every**

## “LE CARBONE”

(Made in France)

## Carbon Brush

in a million is absolutely identical.

This means that a type of **Le Carbone Brush** once installed to meet your conditions will always meet them on subsequent shipments.

*Le Carbone quality never varies!*

**Rougier Freres Inc.**

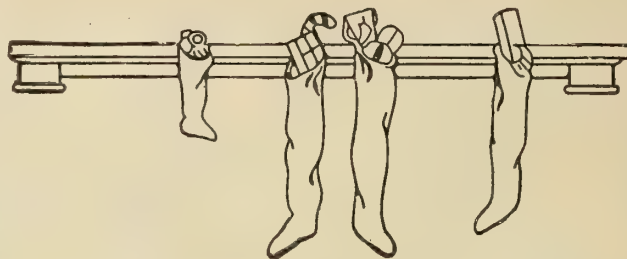
63 Notre Dame, East  
MONTREAL, P.Q.



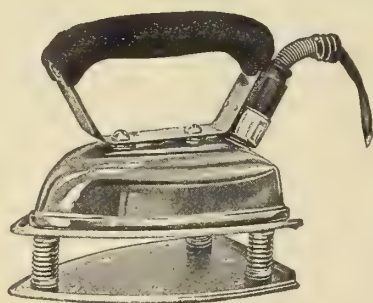
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## For Your Xmas Trade

### Universal Heating Devices



Coffee Percolators   Electric Irons   Warming Pads   Tea Samovars  
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**The Mainer Electric  
Company, Limited**  
Winnipeg, Man.

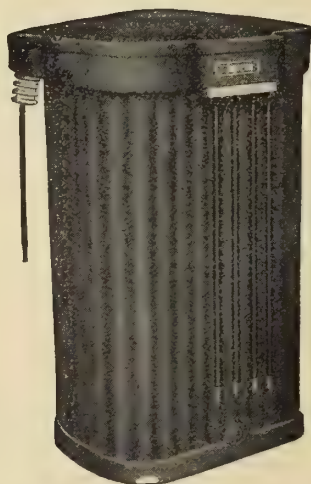


## MOLONEY



Pole Type  
1 to 10 K. V. A. 2200 Volts

**Made in Canada**



Pole Type  
15 to 50 K. V. A. 2200 Volts



3 Phase, Pole Type  
1 to 50 K. V. A. 2200 Volts

**Quick Shipments**

## Moloney Electric Company of Canada, Limited

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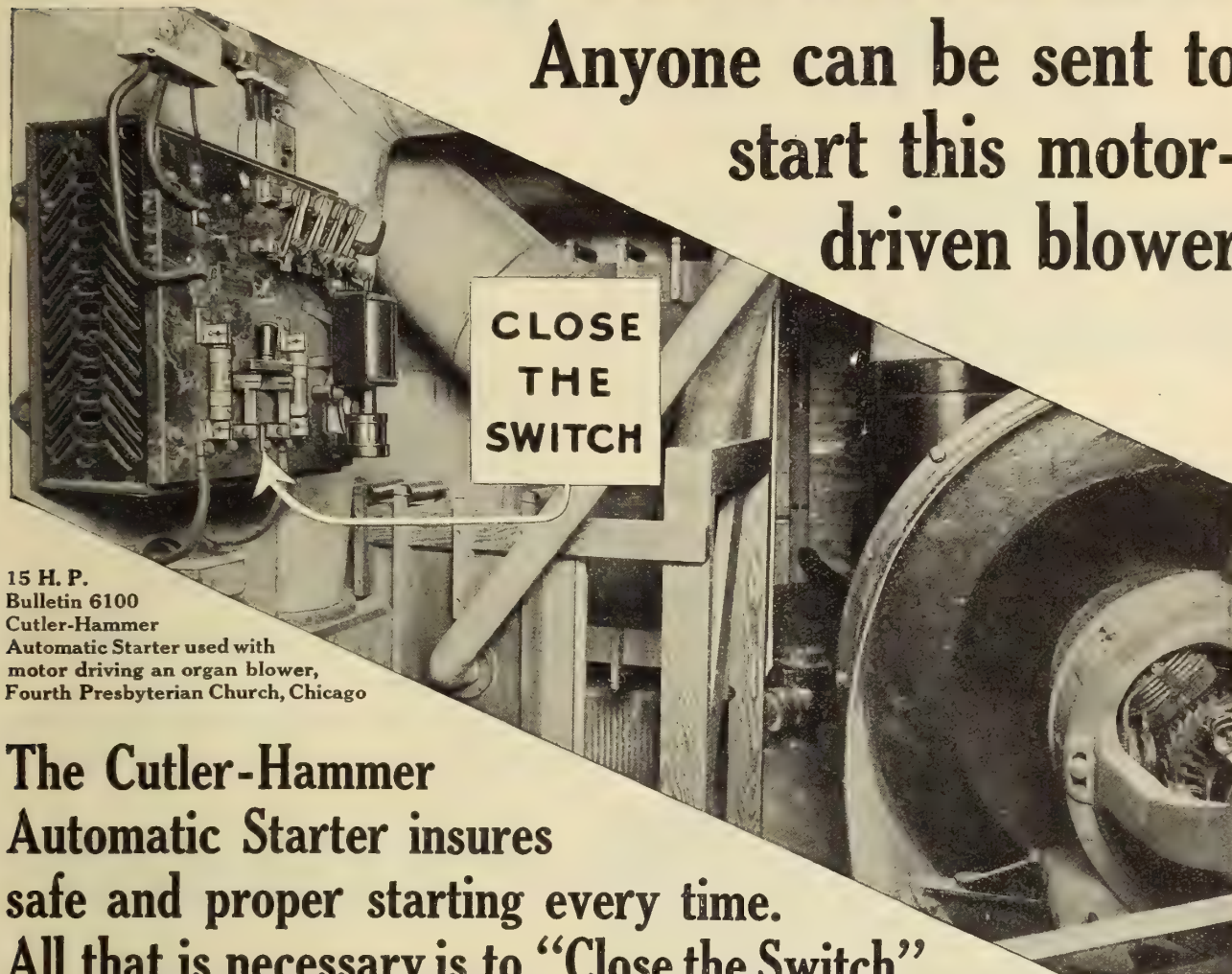
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# CUTLER-HAMMER

Anyone can be sent to  
start this motor-  
driven blower



15 H. P.  
Bulletin 6100  
Cutler-Hammer  
Automatic Starter used with  
motor driving an organ blower,  
Fourth Presbyterian Church, Chicago

**The Cutler-Hammer  
Automatic Starter insures  
safe and proper starting every time.  
All that is necessary is to "Close the Switch"**

A motor that is to be started by any one of a number of persons should be provided with the automatic type starter instead of the hand operated type.

Where the operator is unfamiliar with electrical apparatus or apt to be careless in using a hand starter, the automatic starter is preferable. It insures the motor against improper starting. The closing of a switch or the pushing of a button is all that is necessary. The motor is brought to full speed in the same correct manner each time—regardless of who closes the switch.

The ease of starting and stopping encourages shutting down the motor when not in use—power is saved.

Where dashpot type acceleration is not best adapted, current limiting type automatic starters are furnished.

*Ask for Automatic Motor Starter Booklet.*

**THE CUTLER-HAMMER MFG. CO.**

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**"Do it Electrically"**

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OF EVERY TYPE AND DESIGN



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*The Macey*  
SIGN CO.

257 King Street West,

LIMITED  
TORONTO

Lighting Companies write us about our  
ELECTRIC SIGN CAMPAIGN

"CIRCLE T"



Armored  
Cable



If you use "Circle T" Armored Cable you will have the following advantages: You won't get imperfect windings. You won't get cable that breaks. You will have an even cable that runs absolutely uniform. "Circle T" Cable is made to fit standard fittings.

The following result of a test shows the good quality and workmanship of "Circle T" Cable. We looped the cable and pulled both ends until cable was down to 1 1/4 in. in diameter before the winding gave way. Our average test is 1 1/2 in. Other makes opened up at 2 in. and 2 1/2 in.

The "Circle T" trade mark is stamped on the outside of the metal about every six inches.

SAMPLES ON REQUEST.

**The Trumbull Electric Mfg. Co.**  
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**ADJUSTO SIGN  
DRAWS ATTENTION  
GETS RETURNS.**

## "Adjusto" The Sign Of The Times

There are several electric signs, good, bad and indifferent, but the "Adjusto" sign is the leader of them all—"The Sign of the Times".

It is a million signs in one. The best day sign—white letters against black background. The clearest night sign—showing opaque light flashing the message of increased sales.

"Adjusto" is made right in Montreal for the Canadian electrical dealers and contractors—a money making opportunity.

We can make any style, any number of lines—sufficient letters in each line to meet any requirements. The standard style is 26 letter spaces in one line. We make any shape or style, to suit any business.

*Write us for agency proposition.*

**Canadian Steel Products Company**

227-229 Wellington Street

MONTREAL

Manufacturers of steel cutout and panel boxes and other steel specialties.



# G. M. Gest

## Conduit Engineer & Contractor

Head Office  
503 Power Building, Montreal,  
CANADA

## Perfect Pressure Control

Can be obtained in tanks and reservoirs by starting and stopping the motor driven apparatus with

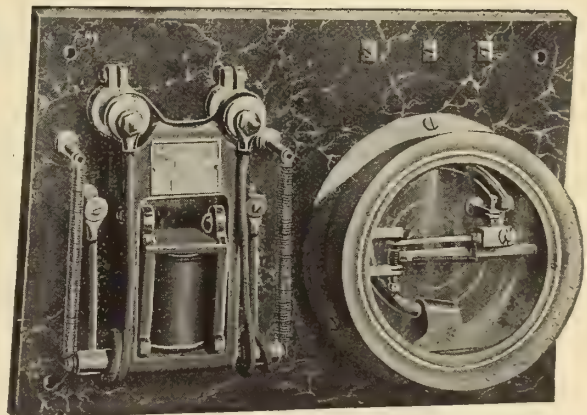
### THE SUNDH GAUGE

### TYPE REGULATOR

The simplest, strongest and most satisfactory regulator made. Operates on a pressure difference of 3 to 5 per cent. of maximum pressure. Wider range may be obtained by screwing down the left-hand screw.

The construction consists of a silver-tipped contact lever attached to the tube and moving between two silver contact points on pressure fluctuations.

The screw on the right is used for adjusting to maximum pressure desired, and the lower screw on left hand is for adjusting for difference in pressure.



Send for "Sundh" catalogue giving complete description of controlling devices for A.C. & D. C.

**Sundh Electric Company**

**New York, U.S.A.**



# ANNOUNCEMENT

## General Devices & Fittings Co.

CHICAGO, ILL., U. S. A.

We are now represented in Canada by three high grade concerns who are ready to serve our customers with our **QUALITY-SERVICE** line of power plant devices and fittings.

**Roper, Clarke & Co., Ltd., Montreal, Distributors for Eastern Canada**  
**A. H. Winter Joyner, Ltd., Toronto, Distributors for Ontario**  
**Bentz-Richardson Co., Ltd., Winnipeg, Distributors for Western Canada**

*Write our nearest representative for prices and data.*

We design and manufacture Bus Bar Supports and Disconnect Switches up to 200,000 volts, any style or type, any mounting; Insulator Pins for any service; Malleable iron pipe frame and switchboard fittings; Clamp Insulator Supports; Tee Connectors; Porcelain Tubes and Bushings, etc.

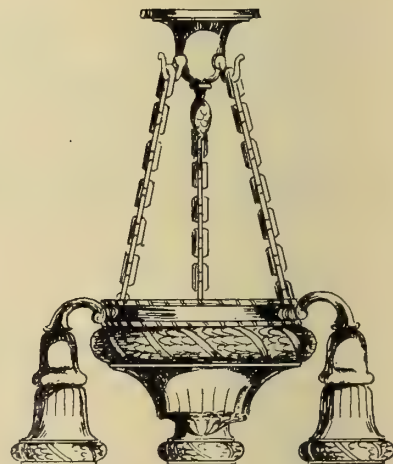
# Tallman Fixtures



2275

*They're  
Different*

**2 December  
Specials of  
Exceptional  
Value**



2276

*Manufactured by*

**Tallman Brass & Metal Co.**  
**HAMILTON, ONT.**





# ANNOUNCEMENT



## The D & W Fuse Company of Providence, R. I.

*Manufacturers of the well known "D & W" Fuse*

Is pleased to advise its customers that it is now represented in Canada by the following concerns and that they are prepared for all requirements with a full line of "D & W" FUSES, CUT-OUTS and BOXES.

Mechanics Supply Company, Limited, Quebec  
Electrical Equipment Company, Limited, Montreal  
Factory Products Limited, Toronto  
General Supplies, Limited, Calgary  
Bentz-Richardson Co., Ltd., Winnipeg, Man.



*Complete Stocks—Prompt Shipments*



## SWEDEN

Has Remained Neutral

## OUR FACTORY

Is Filling Orders as Usual

*Send us your inquiries.*

## SWEDISH GENERAL ELECTRIC

Head Office

TORONTO

1011 Kent Building



General Supplies

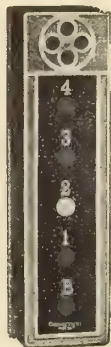
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Limited



**CONNECTICUT****Electric Reset Annunciators**

The push button on the annunciator resets all drops electrically and there are no permanent magnets to demagnetize.



Occupies less space than other drops. One set of batteries for call and reset.

**The Most Sensitive Drop Small Current Consumption**

Several types made in all sizes and styles. Illustration shows Type "L." Connecticut annunciators are thoroughly modern and quality made.

We make interior telephones to meet every requirement. Send for our new Catalog, No. 23, just issued.

**CONNECTICUT Telephone & Electric COMPANY, INC.**  
MERIDEN, CONN., U.S.A.

Southern Representative:—D. R. Peteet,  
415-416 First National Bank B'ldg., Atlanta, Georgia

**CONNECTICUT****New British Ever Ready Electrical Co.**

"B-E-R-E-C" Portable Electric Specialties.

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"Real Red Heat"

**British Aluminium Company****Falkirk Iron Company**

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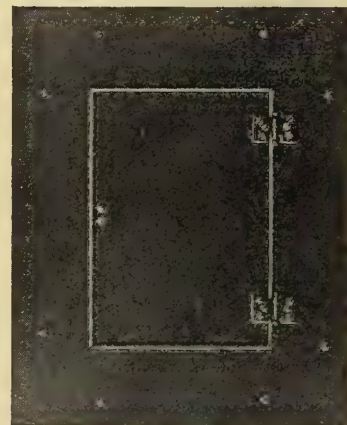
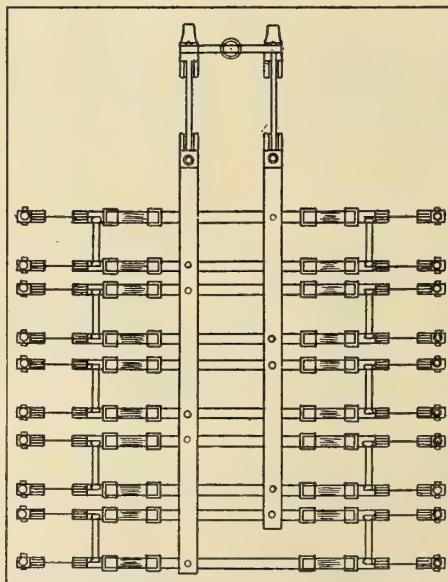
Insulating and Protective Preparations

Write for catalogues to

**SPIELMANN AGENCIES**

(Registered)

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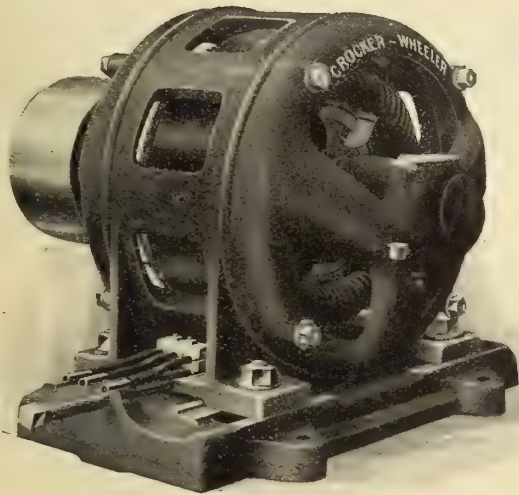
**DEVOE****PANELS**

Devoe Panels are manufactured to meet every underwriter requirement. They are exceptionally strong and handsome, and are used and recommended by all leading Electrical Engineers and Contractors. We make Panel Boards to any specifications and can give you prompt quotations.

**THE DEVOE ELECTRIC SWITCH COMPANY**

Office and Factory, 157 Craig Street West, MONTREAL, Que.





The  
Design of  
**CROCKER-WHEELER**

Induction Motors

includes

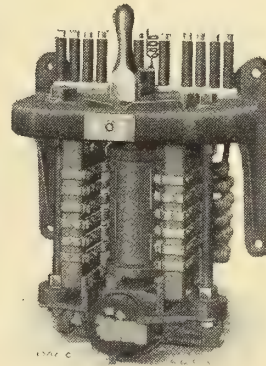
Heavy Shafts

Large Journals

Ideal End Ring Construction

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Excellent Efficiency



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Starter  
with  
Oil Immersed  
No Voltage  
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**THE CANADIAN  
CROCKER-WHEELER CO.  
LIMITED**

MANUFACTURERS AND ELECTRICAL ENGINEERS

*Head Office and Works*  
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*District Offices*  
MONTREAL, TORONTO, VANCOUVER





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### Sturtevant Vacuum Cleaners

(REG. CAN. PAT. OFF.)

We do not expect you to do all the work in connection with selling our vacuum cleaners should you become agents. We do a great deal to help you. These advertisements, stuffers and catalogues are samples. We also do other promotion work to increase the sale of our cleaners.

Sturtevant Vacuum Cleaners have been sold for some years in the United States under the name Western Electric Sturtevant, and have been widely advertised in the popular magazines coming to Canada. 18 sizes—Guaranteed Machine—Write for our proposition.

*Agents wanted.*

**B.F. Sturtevant Co., of Canada**  
Limited

Head Office and Works, Galt, Ontario, Canada

## The Final Test is Service



### BUS BAR SUPPORTS of

*„ guaranteed reliability bear the Triple “E” mark.*

Like all E. E. E. Co. power plant, sub-station or switching equipment, our Bus Bar Supports exactly meet the demands of modern central-station or isolated plant practice.

Our engineering experience is at your service. New Bulletin No. 103 treats of Bus Bar Supports exclusively. Write for it today.

**Electrical Engineers Equipment Company**

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*Northern Electric Company*  
LIMITED

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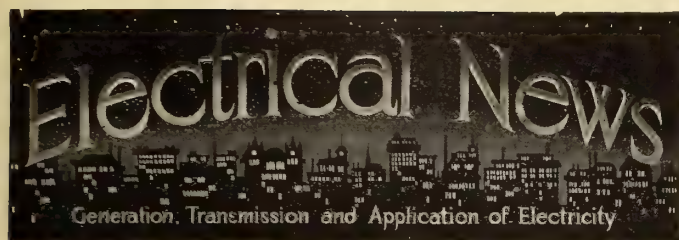
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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for \$2.00 per annum. United States and foreign, \$2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Authorized by the Postmaster General for Canada, for transmission as second class matter.

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Vol. 23

Toronto, December 1, 1914

No. 23

## Human Conservation

This is an age of conservation—conservation of natural resources,—minerals, water powers, forests, and so on,—conservation, no less, of the resources of our citizens, the maintaining of all their faculties, both of mind and body, in a state of highest efficiency and constant readiness for service. As in medical science, so in every line of commerce, this is an age of prevention rather than cure, of foresight in avoiding delays rather than in hurrying to overtake them, of caution in eliminating mistakes rather than in willingness to correct them—all of which means that we are earnestly seeking for any and every development of modern science which will help to make and keep the human machine in its highest state of efficiency, ready to turn out a maximum of product of the best possible quality. This is equally true of every class of workman, whether his work is mechanical or mental, or a combination of both.

It is failure to appreciate these changed conditions and the tremendous possibilities of this new order of things, that accounts for so many big employers of labor still contenting themselves with under-efficiency in both equipment and men. They will invest money in anything but "efficiency"—largely, no doubt, because efficiency has not been capitalized, distributed in the form of gilt-edged certificates, listed on the stock exchange, or made the excuse for promises of big dividends. Yet, as a matter of fact, an investment in "efficiency" equipment will yield bigger returns than any other investment. It has never yet "passed" a dividend. Profits are surer in years of depression than in good times; surer in war than in peace. Efficiency welcomes competi-

tion, new conditions, added responsibilities. Human faculties, thoroughly trained and properly conserved, are strengthened with every obstacle met and overcome.

But it must be remembered that efficiency in the human being means both the condition within the man himself and the conditions surrounding him. A first-class workman operating under unfavorable conditions is no better than a poor workman operating in favorable surroundings,—neither will turn out a first-quality product. Many employers of labor pay big wages to skilled men and then hamper their work with poor machinery, poor tools, poor heating and ventilation—poor lighting. Each of these items plays a most important part in the day's work, but especially we are anxious to draw the attention of employers to the value of good lighting in office, warehouse or factory, because—possibly to a greater degree than any of the others—good lighting adds tremendously to the efficiency of your plant in three distinct ways:

(1) **Quality:** There are few mechanical operations that cannot be performed better by good daylight than by artificial. It follows that the nearer to daylight your artificial lighting can be made, the better quality work your men can turn out. With the most approved methods of installation, supplemented by the proper lighting units, a very near approach to this condition can now be obtained, and should be insisted on wherever a number of men are employed. The condition of the workman is also a very important factor in the quality of his work, as it is now an accepted physiological fact that poor lighting reduces both the capacity and the inclination of the individual to produce results.

(2) **Quantity:** Unsatisfactory conditions of working spell delay, and delay means reduced consumption. It is important that the workman should be producing every minute of the day. Suppose poor lighting causes him to go to the window for the closer inspection of his work, to hesitate in some mechanical operation for safety's sake, to rest his eye owing to unnecessary tension, or to become tired before his day's work is done, then the quantity of work is less than he could turn out under more favorable conditions. If a man is paid, say, \$5 a day of eight hours or practically one cent a minute, he does not need to lose many minutes every day before he has lost for his employer more than the original cost of a correct lighting installation.

(3) **Safety:** Correct illumination is the best and cheapest form of industrial insurance. It has been shown that, averaging a large number of typical factories, the number of accidents was formerly inversely proportional to the number of hours of daylight. Quite aside from humanitarian considerations, then, a poorly lighted factory is an expensive system for any considerable employer of labor to maintain. Under improved lighting conditions, as we can produce them today, this state of affairs is being largely overcome. Factory managers are beginning to realize that a single accident avoided will well repay them for the rehabilitation of their whole system.

## Sub-Station Exterior Design

In previous issues we have called the attention of our readers to the big possibilities of improvement in the appearance of power-houses, sub-stations, etc., all over Canada. The addition of a little beauty in design adds a comparatively insignificant amount, often nothing, to the cost of a building, and there is gained the distinct educative value of this constant reminder of the pleasurable effects of simplicity and correct proportion.

It is quite time we should get away from the idea that any old building will do for an electric power house or sub-station; for commercial reasons alone, if there were no others, this is true. We want to impress the public with the idea (the correct one) that the use of electricity means added cleanliness, neatness and beauty in our homes. The



ordinary power-house suggests none of these things. It should suggest all.

The Hydro-electric Power Commission of Ontario have it in their power to vastly improve the standard of design of electric buildings in the province at least, and indirectly all over the Dominion. That they have kept this feature in mind is evident from the very prepossessing buildings they have erected throughout the districts served. A typical smaller sub-station is shown herewith. This represents an inexpensive building, the Streetsville sub-station, built for



Typical sub-station of H. E. P. Commission of Ontario.

\$800 or \$900, and of sufficient capacity to accommodate three 200 kv.a. transformers, 13,200 volt switching and protective apparatus, and three or four panel switchboards. Most of these structures built by the Commission are of pressed brick. It is the good lines in the design of these buildings that adds most to their effectiveness, however. Their simplicity and solidity also suggest power. With a little attention to the surroundings, such buildings are a source of pleasure, pride and education to the community.

## Inspection Department Report

The Department of Inland Revenue for the Dominion of Canada has just issued its annual report for the year ending March 31st, 1914, dealing with weights and measures, gas and electricity. It is pointed out in the introduction that the two services of gas and electricity inspection, which are conducted largely by the same staff of officers, have, since 1896, ceased to be a burden upon the general taxpayer. For the twelve months covered by the report, the gross revenue was \$143,386, as against \$13,014.

A certain reduction of the fees in connection with both gas and electricity inspection was made in 1909 and 1911, but the report hints that, inasmuch as this has not yet brought about an equilibrium between receipts and expenditures, a further reduction will be made.

The revenue derived from the section of electricity alone for the year ending March 31st, 1914, was as follows:

Fees for inspection of meters, etc. . . . .	\$80,476.50
The expenses of inspection (annual) . . .	\$39,347.02
Expended on standard instruments, and	
maintenance of equipment . . . . .	10,788.27
	<hr/> 50,135.29

Leaving a net revenue of . . . . . \$30,341.21

On the supposition that the amount expended on instruments and equipment maintenance is normal, it would appear that a considerable reduction in fees is possible. It must not be overlooked, however, that this work of standardization requires instruments of highest possible quality, which are very expensive. It is open to question whether the department is any too well equipped for the important work

TABLE I.

Districts.	Presented for Verification.	Verified as coming within the error tolerated by law.			Rejected.			Verified after first Rejection.			Totals.	
		Correct.	Fast.	Slow.	Unsound.	Fast.	Slow.	Correct.	Fast.	Slow.	Verified.	Rejected.
Belleville.	2,753	995	1,312	442	8	1					2,749	4
Fort William.	3,337	1,332	1,311	1,264	12	18					3,907	30
Hamilton.	12,428	8,855	1,231	2,341							12,427	1
London.	7,696	2,798	2,820	2,069		5	4				7,687	9
Ottawa.	8,108	1,369	4,199	2,506	9	7	18				8,074	34
Toronto.	23,829	13,238	7,178	3,405		1	7				23,821	8
Montreal.	20,485	18,242	1,701	539		3	1				20,482	3
Quebec.	2,263	1,232	601	430							2,263	
Sherbrooke.	941	375	238	328							941	
St. Hyacinthe.	1,157	305	655	192		3	2				1,152	5
Three Rivers.	157	136	16	5							157	
St. John.	2,210	1,008	862	529	5	2	3	1			2,199	11
Halifax.	3,032	1,984	464	539	36	3	6				2,987	45
Charlottetown.	490	178	71	226		1	14				475	15
Winnipeg.	11,014	2,916	7,355	733		1	9				11,004	10
Regina.	5,325	1,830	2,167	1,320	3	3	2				5,317	8
Calgary.	3,706	1,347	1,976	371		8	4				3,694	12
Edmonton.	5,143	1,709	2,938	472	1	13	10				5,119	24
Vancouver.	9,845	2,881	5,838	1,122		4					9,841	4
Victoria.	4,175	2,152	1,085	938							4,175	
Totals.	128,695	64,882	43,818	19,771	54	69	100	1			128,471	224

to be performed. The total number of meters presented for verification during the period covered by this report was 128,695. Of this number 224 were finally rejected. It is interesting to note that of those verified as coming within the error tolerated by law, 43,818 were fast as against 19,771 that were slow. Only 54 meters out of this number were rejected as unsound.

A very interesting section of the report is given over to the quantity of power produced in Canada by companies operating at or near the border line, and which generate power both for consumption in Canada and for export to the United States. The total amount produced for export is almost exactly the same as that produced for home consumption, being a little over 770,000,000 kw.h. in each case. Of the seven companies at present manufacturing for export, three export considerably more than half of their product; these are the Canadian Niagara Power Company, which exports 400,000,000, as compared with a home consumption of 11,000,000 kw.h. The Ontario and Minnesota Power Company at Fort Francis, which exports nearly 22,000,000 as against less than 1,000,000 kw.h. consumed in Canada, and

TABLE II.

	Units Produced for Export.		Units Produced for use in Canada.		Total Output of Generating Station or other Source.	
	K. W. Hours.	H. P. Years.	K. W. Hours.	H. P. Years.	K. W. Hours.	H. P. Years.
Ontario Power Co. ....	282,123,004	43,168 '36	412,597,896	63,137 '10	694,720,500	106,305 '46
Canadian Niagara Power Co. ....	400,214,980	61,241 '15	11,420,020	1,747 '63	411,635,000	62,988 '38
Electrical Development Co. ....	42,154,000	6,413 '53	191,885,670	29,356 '78	234,039,670	35,800 '31
International Railway Co. ....						
Electric Distributing Co. ....						
Ontario and Minnesota Power Co. ....	21,649,327	3,306 '60	868,856	132 '95	22,518,183	3,439 '55
Maine & New Brunswick Electric Power Co. ....	2,846,016	435 '49	57,967	7 '87	2,903,983	444 '36
Cedar Rapids Power and Manufacturing Co. ....						
Sherbrooke Railway and Power Co. ....						
British Columbia Electric Railway Co. ....	395,831	60 '58	114,697,400	17,511 '56	115,093,231	17,612 '14
Western Canada Power Co. ....	28,213,891	552 '28	39,339,239	6,019 '83	62,553,130	9,572 '1
Totals .....	772,597,049	118,207 '99	770,867,048	117,965 '62	1,543,464,097	238,162 '61

‡ These companies have not yet commenced to export.

the Maine and New Brunswick Electric Power Company, which exports nearly 3,000,000 kw.h., to a home consumption of 58,000. The complete list of production, export and home consumption is given in one of the accompanying tables.

The Dominion Government have refused the application of the city of Halifax for disallowance of an act passed at the last session of the Nova Scotia legislature and known as the Act to Incorporate the Nova Scotia Tramway & Power Company, Limited. The company has a capital of \$6,000,000 with power to increase to \$10,000,000.



## Letters to the Editor

Editor, Electrical News,  
Toronto, Ont.

Dear Sir,—

We notice on page No. 43 of your November 15th edition of the Electrical News an interesting article on testing instruments manufactured by the Weston Electrical Instrument Company.

We desire to correct a mis-statement at the end of this article which says:

"That these instruments are for sale by the Northern Electrical Company, Limited, who are the Canadian Agents for the Weston Electrical Instrument Company."

The Northern Electric Company are not the Canadian Agents for the Weston Electrical Instrument Company, although we believe they represent them in some districts in Canada. We also wish to state that we are the Ontario Agents for the Weston Electrical Instrument Company. We have been the Ontario Agents for them since the writer started business, and any information which implies that the Northern Electric Company, Limited, are the Canadian Agents is a direct misrepresentation of the facts.

We trust that you will give this letter space in your valued journal. We are,

Yours very truly,  
A. H. Winter Joyner Limited.

Toronto, Ont., Nov. 21st, 1914.

### Grounding Secondaries

The following letter from the city of Winnipeg's city electrician, is one more testimony to the recognized value, and the consequent urgency, of grounding the secondaries of low voltage distributing systems.

Mr. Cambridge is none too emphatic in his statement that "it will undoubtedly eliminate fatal accidents such as alluded to." It is gratifying to note the determined stand taken by the Manitoba Public Utilities Commissioner, Mr. H. A. Robson. Mr. Cambridge's letter, and Mr. Robson's order in this matter are both reproduced below.

### Mr. Cambridge's Letter

Editor, Electrical News,  
Toronto, Ont.

Dear Sir:

I have read with much interest your editorial remarks on the question of grounding of secondaries of a.c. systems.

Thinking it may be of interest to your readers, I enclose copy of Order of the Public Utility Commission of this province, calling for the grounding of all low voltage secondary systems in this city. This work is now proceeding. A very great saving is being reached in the matter of cost by the two competing interests using ground connections in common, where feasible. All grounds are made to city hydrants through a special lug into which the ground wire is brazed, the lug being attached under one of the hydrant bolts. No joints are attached in the wire underground and the wire is not allowed to cross a street owing to the danger of it being interfered with. To cover the two distributing systems in a city of this size with a protective system of this kind will take some time and will certainly cost a considerable amount, but I am satisfied the outlay will be thoroughly justified, as it will undoubtedly eliminate fatal accidents such as alluded to by you and which we have also experienced here.

Yours very truly,  
F. A. Cambridge,  
City Electrician.

Winnipeg, November 21, 1914.

### Mr. Robson's Order

#### In the Matter of the Grounding of Transformer Secondaries

Upon the Commissioner's initiative and upon hearing various persons interested, including representatives of the city of Winnipeg (Light & Power Department), the Winnipeg Electric Railway Company, and Mr. T. J. Murray and Mr. J. B. Pegg, representing the workmen engaged on electrical line work, it is ordered:

1. That the said city of Winnipeg (Light and Power Department) and the Winnipeg Electric Railway Company do in all cases ground its transformer secondaries of distribution system where the potential of such circuits does not exceed two hundred and fifty volts, and the following directions shall be observed:

All ground connections must be made at the poles where individual transformers are installed, and not within the building of the consumer, unless by special authority of the City Electrician in writing, nor shall the service switch on either the consumer's side or the service side be connected to the ground. Secondary circuits over 1,000 feet long must have one ground for each 1,000 feet or fraction thereof.

In the case of underground distributing systems the grounds must be made to the water mains in the case of individual transformers. In the case of secondary mains supplying a number of customers ground connections shall be made to the water mains, either 1,000 feet apart, or to a continuous ground wire of ample conductivity, connected in the same manner.

The ground connection is to be made wherever possible by connecting to the city's water mains with a wire of suitable size, but in no case less than No. 6 B & S gauge, so that the total resistance from the point of connection to the service to the water pipe will be less than one-half of one ohm. Care must be taken in making connection to water pipe to insure a perfect mechanical and electrical connection.

All single phase, two wire secondary circuits are required to be connected to ground on one side of the circuit, and all three wire circuits to be grounded at the neutral wire. All multiphase secondary circuits must be grounded from the neutral point of the phase connections, provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts.

In cases where owing to the inaccessibility of a water main or pipe it is impracticable without extraordinary expense to ground thereto, the City Electrician may designate another manner suitable to him in which the grounding may be affected.

All work to be done under this order shall be subject to the supervision of the City Engineer, whose permission is to be obtained, and who is to be notified at least forty-eight hours before the proposed work is commenced.

Existing regulations as to opening of the ground of any street or lane are to be observed.

Each of the parties affected hereby shall give written notice to the City Electrician of all work done by them towards compliance with this order.

2. That the said Winnipeg Electric Railway Company, and the City of Winnipeg (Light & Power Department) do proceed with all practicable diligence to ground in manner aforesaid transformer secondaries in existing installations so as fully to complete such grounding not later than January 1st, 1915, or such later period as may be ordered in the event of diligence meanwhile being shown.

3. This order will be effective on this date (April 12, 1914) in the public interest.

(Signed) H. A. Robson,  
Commissioner.



## Montreal Arena's Ice Plant

The Montreal Arena Company have just installed a plant for producing manufactured ice for commercial purposes and for an ice skating surface. The plant, housed in a separate two-storey building on St. Catherine Street, is operated by electric current supplied by the Montreal Light, Heat and Power Company. The refrigerating machines, made by the Canadian de La Vergne Limited, are belt driven by two 80 h.p., 3 phase, 497 r.p.m., 2200 volt, slip-ring motors manufactured by the Triumph Electric Company, of Cincinnati, speed control equipment being of the Cutler-Hammer drum type. The ice tank for making commercial ice is operated by a 550 volt Triumph squirrel cage motor, driving by belt an agitator in the brine tank, the ice being taken out with a crane fitted with a 2 h.p. electric hoist. A small circulating pump direct connected to a 2 h.p. squirrel cage motor circulates the purified water to be made into commercial ice of 400 pound blocks.

In connection with the refrigerating machinery, tandem air compressors (Canadian Ingersoll Rand make) are installed, these having high and low pressure cylinders independent of each other; the high pressure side pumps an artesian well and the low pressure furnishes air for the agitator of the commercial ice making tank. For the circulation of brine for the skating rink floor, two  $7\frac{1}{2}$  h.p., 3 phase, 550 volt Triumph slip-ring motors are direct connected to centrifugal pumps. These motors have Cutler-Hammer controls. A  $3\frac{1}{2}$  h.p. Triumph motor is direct connected to a centrifugal pump for circulating water to the spray pond for cooling purposes.

The Montreal Light, Heat and Power Company supplies two services at 2200 volts, the services being transformed by three 15 kw. Packard Electric Company, Limited, transformers, to 550 volt for power purposes for the small motors, and 110 volt for lighting. A panel board, made by the Monarch Electric Company, St. Lambert, P.Q., is fitted with a double throw switch, one side operating a 5 h.p. Wagner motor which drives a compressor to be used as a stand-by for the agitator in case of interruption to the current; the other side of the switch operates the other line of motors. The switchboard is also fitted with a voltmeter, two ammeters connected to the 80 h.p. motors, two oil switches with no-volt and overload releases for the operation of the 80 h.p. motors, and a 10 volt lighting switch. The wiring contract was carried out by the Century Electric Company, Montreal, who also supplied the switches. Mr. H. R. Drackett is the engineer responsible for the design and installation of the plant, with Mr. J. Bennett as consulting engineer. Most of the electrical equipment was supplied by the Rudel-Belnap Machinery Company, Limited, Montreal.

## Electrical Equipment of Mountain Park Coal Co.

The Mountain Park Coal Company, situated 220 miles south-west of Edmonton on the G. T. P. Railway has plans that, when fully developed, will give an output of 2,500 tons a day. At the present time, on a four-day working schedule per week and with a reduced gang, the company are getting out approximately 250 tons. The mining rights include 360 square miles in the immediate vicinity of their present plant.

This mine, though still in its infancy, is operated altogether by electricity. The power-house is located in the centre of the three drift shafts at present in operation, and contains the following equipment:—Three Robb horizontal tubular boilers, 150 h.p. each, working at 125 pounds pressure; one Robb high speed horizontal engine, 125 h.p., belt connected to a 100 kw. Century d.c., 220-volt generator; one 400 h.p. Robb high speed horizontal engine, belt connected to a Westinghouse 325 kw., 220-volt generator. The switch-

board consists of a three-panel slate having one large ammeter and voltmeter together with the necessary switches.

There are two fan-houses located near the mining shafts. The fans were supplied by Sheldons' Limited, Galt, Ont., and are driven by Westinghouse 20 h.p., 220-volt, d.c. motors.

The company advise that the use of d.c. equipment allows of a more flexible arrangement for controlling the motor speeds but it has the disadvantage of a fluctuating voltage which is quite noticeable on the lighting circuits.

When this mine is fully developed, it will, according to present expectations, be one of the most modern in western Canada. The present generating station will then give place to much larger units and the whole plant will be rebuilt according to the most approved specifications as soon as the increasing business warrants the expenditure.

## Coronation Now Electric Lighted

The town of Coronation, Alta., inaugurated its new system of electric lighting and water works on October 15th. The Canadian Pacific Railway Company operated its first train into Coronation on September 15th, 1912, and to-day this village of yesterday has a population of over 800 and is doing a thriving business, as it is the centre of a good agricultural community. It is certainly indicative of the progressiveness of the citizens that they should have installed an up-to-date electric light plant. The equipment consists of two Watrous return tubular horizontal boilers of 100 h.p. each, a McEwan engine, 14 by 14, 227 r.p.m., horizontal type, direct connected to a Westinghouse 75 kw., 2,300 volt, 60-cycle, three-phase generator. The switchboard is a one panel, Vermont marble, fitted with a Westinghouse meter, a voltmeter and recording wattmeter. There is also one arc light panel and one constant current transformer supplied by the Canadian General Electric Company. The town is at present installing an ornamental street lighting system, using 5-light Park-way standards of an attractive design.

The water pumping equipment is also situated in the power house and consists of one deep well steam pump and one high pressure fire underwriters' pump manufactured by the Canada Foundry Company. The municipality have built a large service reservoir together with a 20,000-gallon tank supported on steel structure 100 ft. above the ground.

## Guelph Gets Low Rates

New rates go into effect in Guelph on January 1st, 1915, similar to those recently announced for Galt. The domestic lighting rate will be 3c per 100 sq. ft. for a minimum floor space of 1,000 ft. and a maximum of 3,000, with an additional meter rate of  $2\frac{1}{2}$ c per kw.h.; 10 per cent. discount is given off the total value for prompt payment. For commercial lighting the rate is 6c per kw.h. for the first 30 hours' use of installed capacity and  $2\frac{1}{2}$ c per kw.h. for all in excess of this amount; 10 per cent. discount. The power rate is \$1 per h.p. plus 2c per kw.h. meter rate for the first 50 hours' use of installed capacity,  $1\frac{1}{2}$ c for the second 50 hours and .2c for the balance; a discount of 25 per cent. and 10 per cent. is allowed on the power bills. The street lighting has been reduced from \$9 per lamp of 100 watt capacity to \$8.50 per lamp, per year.

In order to have a reserve supply of power in case the supply now drawn from the municipal plant gives out, the Ottawa Waterworks Department has contracted with the Ottawa Electric Company for an additional transmission line to be connected with the pumping plant at Lemieux Island. The Department recently advertised for four centrifugal, direct connected, 15-million gallon pumps, each to be driven by a 50 h.p. motor.



# Making Our Water Powers Valuable

## A Discussion of the Further Uses to Which Our Water Powers Might be Put—Huge Requirements of Industrials—Some Interesting Comparative Figures

By Arthur Surveyer\*

The utilization of the slope of rivers for power purposes is as old as history, but the harnessing of the larger and higher water falls has been a modern victory achieved in the last fifty years.

The chief factors in this conquest were the superseding of the old current wheel by the modern turbine developed by Fourneyron and Francis, and the discovery of the application of electricity.

In this connection a few words may not be amiss. Between 1840 and 1850, the two French engineers, Fourneyron and Girard, both utilized water falls of over 325 feet in height to operate their turbines. These trials were not, however, entirely successful and it was only in 1869 that another French engineer, Aristide Berges, succeeded in operating steadily a turbine under a head of over 650 feet. This wheel was connected to the wood pulp grinders of a paper factory situated at Lancey. Because of the success of his first venture, Berges erected in 1873 another turbine, this time under a head of 1,640 feet.

Towards 1880 the Belgian electrician Gramme announced the development of his alternator, which was to be subsequently improved by Kapp and Westinghouse. Just at that time, or to be more accurate, from 1880 to 1883, the French engineer Marcel Deprez conducted some very important experiments on the transmission of electricity, on a line eight miles in length running between the town of Vizille and the city of Grenoble.

This was followed by the invention of the transformer in England by Gaulard and Gibbs in 1882, and of the automatic turbine governor by Piccard in 1885.

Previous to these dates energy had been transmitted by cables at Schaffhausen and at Fribourg, and by water under pressure at Geneva and Zurich.

These component parts of the modern hydro-electric plant were first assembled into a working whole at Lauffen, in Germany, in 1891. The energy was generated at 50 volts, then stepped up to 13,000 volts and transmitted to the Frankfurt Exhibition, 75 miles away.

The first development in America was a 15,000 h.p. plant constructed at Niagara Falls in 1893. Since 1893 the technics of hydro-electric work has progressed wonderfully, and the recent improvements in insulation have made possible the economical transmission of energy for distances of two hundred miles and over, whilst the improvement in modern turbine construction has allowed of the commercial development of low heads which could not have been considered ten years ago.

The conflict now raging in Europe has practically called a halt to our industrial development, and it has struck the speaker that this marking time period is especially adapted for a review of past achievements and a survey of the work which may be done in the future.

Lately our economists, statesmen, and journalists have extolled our water powers and have been pleased to see in the number of our water falls the guarantee of our future industrial superiority. Without desiring to minimize in any way the importance of this national asset, it might be interesting to compare this wealth with the similar wealth of other countries and to examine whether or not we are making or are preparing to make the best possible use of it.

Table I. has been compiled from various European sources, from the reports of the United States Geological

Survey and from the report of the Canadian Commission of Conservation. It shows the total available and the developed water powers in the different countries of Europe, in the United States, and in the various provinces of Canada; it also indicates the percentage of utilization for each country and the horse-power per square mile.

Table I.

	Hydraulic Power Available	Power Available on Turbine Shafts Developed	Percentage of Utilization	Available Power per Sq. Mile
	h.p.	h.p.	%	h.p.
<b>EUROPE</b>				
Great Britain . . . .	963,000	80,000	8.3	1.00
Germany . . . . .	1,425,000	445,000	31.2	1.18
Switzerland . . . .	1,500,000	380,000	25.0	3.71
Spain . . . . .	5,000,000	300,000	6.0	3.86
Italy . . . . .	5,500,000	565,000	10.2	4.22
France . . . . .	5,857,000	650,000	11.1	5.80
Austria-Hungary . .	6,460,000	515,000	8.0	7.34
Sweden . . . . .	6,750,000	550,000	8.2	7.72
Norway . . . . .	7,500,000	920,000	12.3	14.12
	40,955,000	4,405,000	10.6	5.44
<b>NORTH AMERICA</b>				
United States . . . .	26,736,000	4,016,000	15.0	7.49
<b>CANADA</b>				
Saskatchewan . . . .	20,000	45	0.2	.19
Alberta . . . . .	71,000	7,000	9.8	.69
Nova Scotia . . . .	83,000	15,000	18.0	3.93
New Brunswick . .	280,000	10,000	3.6	10.03
Manitoba . . . . .	410,000	48,000	11.7	6.37
British Columbia .	1,100,000	101,000	10.1	2.81
Ontario . . . . .	3,400,000	504,000	14.8	15.41
Quebec . . . . .	5,600,000	328,000	5.8	16.38
North West Ter't's.	6,900,000	.....	0.0	3.19
	17,764,000	1,013,045	8.2	6.55

The data contained in this table refer to conditions in the year 1911, and the provincial areas used to calculate the figures of the last column are taken from the Canadian Atlas of 1906.

It would have been more interesting if complete figures for 1914 were available. Unfortunately, nothing authentic could be obtained except in a few instances. The inclusion of the new Shawinigan development, the Canadian Light & Power Company's plant, and the large development at Cedars would raise the figures for the Province of Quebec to over 500,000 developed horse-power. Switzerland's present figures are about 550,000 h.p., Norway's over 1,000,000 h.p., and that of the United States between 5,500,000 and 6,000,000 h.p.

It is probable that the data concerning Europe and the United States are fairly accurate, whilst the Canadian figures are based on doubtful information. The Conservation Commission of Canada in its report of 1911 did not "consider advisable to make an estimate of the total water power in Canada," adding, "one estimate places it at nearly 17,000,000 h.p.; but it does not, and cannot, rest upon any basis of reliable information."

A careful study of this table will alter many of our preconceived ideas; we must realize that our country is not the wealthiest in water powers, especially if we compare our different provinces with countries of practically similar area, say France, Austria, Sweden and Norway. It is true that the

\*Read before the Canadian Society Civil Engineers.



ticular time, Germany's high percentage, 31.2 per cent. utilized, and to observe that the next country on the list is Switzerland with 25 per cent., chiefly acquired through the investment of German money.

Tables II. and III. refer more closely to the subject and supplement to a great extent the information given in Table I.

Table II.

Provinces	Subdivisions of Developed Power.			
	Developed Power. h.p.	Electrical Energy. h.p.	Pulp and Paper. h.p.	Various Industries h.p.
Ontario . . . . .	504,000	394,000	46,000	64,000
Quebec . . . . .	328,000	198,000	88,000	42,000

Table II. has been compiled from the report of the Canadian Commission of Conservation and details the uses made of the developed water powers in Ontario and Quebec. It is to be noted that 74,000 electrical horse-power are exported from the Province of Ontario to the United States at Niagara Falls, and this amount is therefore not included in Table III.

Table III. indicates the uses made of the hydro-electric energy generated in Ontario, in Quebec, in France, in Sweden, and in Norway. The data for the provinces of Ontario and Quebec were taken from a paper by Mr. Watson Bain on the "Electro-Chemical Industries in Canada." The information for the other countries is the result of the compilation of statistics up to 1910. The conclusions resulting from the examination of Table III. are that up to the present we have only progressed in the more simple applications of electricity, and that we have practically neglected its utilization as an electrolytic agent and as a heat generating agent in electro-chemistry and electro-metallurgy.

Table III.

Countries	Developed Hydro-Electric Power. h.p.	Subdivision of Developed Power.			
		Electro-Chemistry and Electric Metallurgy h.p.	%	Motor Power, Traction and Lighting. h.p.	%
France . . . . .	592,000	291,000	49.1	301,000	50.9
Norway. . . . .	543,000	275,000	50.6	268,000	49.4
Sweden . . . . .	370,000	120,000	32.4	250,000	67.6
Ontario . . . . .	320,000	25,000	7.8	295,000	92.2
Quebec . . . . .	198,000	28,000	14.1	170,000	85.9

It would probably be easy to explain this one-sided development of our hydraulic powers, but the important thing now is the patient search for ways and means to enable us to alter these conditions.

It is self-evident that the consumption of electricity for lighting or for traction depends on population. Neglecting the Montreal market, which is exceptional, the consumption of electricity per capita for either lighting or for traction is too small to be considered as an inducement to the extensive development of our water falls. A western statistician gives the consumption of electricity in small towns as roughly 1/10 of a horse-power per inhabitant, so that a plant of 1,000 h.p. would, on this basis, be sufficient to supply the requirements of a town of 10,000 population. On the other hand, the smallest electro-chemical or electro-metallurgical industry consumes more than 1,000 h.p. Plants of 10,000 h.p. are numerous, and those of over 30,000 h.p. are by no means exceptional.

The pulp and paper industries are also great users of power, but we in Canada are not so very far behind in this phase of development, although Sweden utilizes over 120,000 h.p.

An improvement in the situation might be brought about by attracting to Canada more electro-chemical and electro-metallurgical industries, thereby causing a notable increase in the development of our water powers. It has been thought advantageous to briefly review some of the industries

which, either on account of the abundance of the necessary raw materials, or because of the large neighboring markets, might be likely to prosper in Canada.

### ELECTRO-CHEMISTRY

**Calcium carbide.**—Calcium carbide is obtained by causing quick-lime to react on coke at the temperature of the electric arc: its principal use is in the production of acetylene gas and more recently for the production of calcium cyanamide.

The industry of calcium carbide was started in 1895, with Mr. Wilson, of Ottawa, as one of the pioneers. There are now over seventy plants situated all over the world requiring 360,000 h.p. for their operation. The world's production for 1910 was 250,000 tons; it was 300,000 tons in 1912, and increased to 340,000 tons in 1913.

One special feature of the carbide industry is that many of the producing countries are not users of the product and that the centres of consumption are located in places where it is impossible for want of water falls to manufacture carbide. Consequently, calcium carbide is a travelling product, and about 50 per cent. of the production of the different plants is exported to other countries. Germany, England, Austria, and the South American Republics are the importing countries; the consumption of Germany has increased five-fold in the last fourteen years, having risen from 11,000 to 55,000 tons annually. The exporting countries are Sweden, Norway, Switzerland, and the United States. The production of the United States in 1913 was 70,000 tons, with an export trade of 15,000 tons. The American exports go to South and Central America, where the demand for acetylene for house lighting is rapidly increasing.

The manufacture of calcium carbide is the oldest of the electro-chemical industries in Canada. There are at present in operation three plants absorbing altogether 14,000 h.p., and producing every year about 12,000 tons, half of which is exported. The Thorold plant has been in operation since 1897, producing over 1,000 tons a year. The Ottawa plant supplies over 4,000 tons, and the Shawinigan Falls' works about 7,000 tons. These three plants have recently been amalgamated under the name of the "Canadian Carbide Company," with a capital of \$2,000,000.

**The nitrogenized products.**—The study of the consumption of the azotized or nitrogenized products leads into the domain of the agricultural engineer, and necessitates a statement of the part played by nitrogen in the vegetable kingdom. Plants must have nitrogen to live. The leguminous plants and a few others only can borrow the nitrogen required for their existence from the atmospheric air. The great majority of vegetables are obliged to obtain the azotized compounds necessary to their life from the ground itself.

The principal nitrogenized fertilizers are manure, dried blood, wood wastes, horn, leather, nitrate of soda, sulphate of ammonia, calcium cyanamide, and nitrate of lime.

Nitrate of soda or Chili saltpeter is the best known of the imported fertilizers; it is found in its natural state in immense deposits situated in Chili, Peru, and Bolivia. The export of Chilean nitrates was only 100 tons in 1830, 147,000 tons in 1870, then increased to a million and a half tons in 1904, and is now over 2,500,000 tons annually.

The story of the fixation of atmospheric nitrogen can be summed up as follows: in 1902, the Atmospheric Product Company erected in Niagara Falls a trial plant for the manufacture of nitric acid by the Bradley and Lovejoy process. During the same year, de Kowalsky began in Fribourg a series of researches which were continued by Moscicki and led to the erection of a trial station at Vevey, in Switzerland; in 1903, Professor Birkeland, of Christiania, discovered a new process which was afterwards perfected by Birkeland and Eyde, and is now applied on a very large scale at Notodden in Norway. In 1903, also, Frank and



Caro made public a new method of fixation based on a different principle and giving calcium cyanamide as the final product. More recently, Pauling and Schönherr have taken out patents for other processes.

All the methods quoted above, with the exception of the Frank and Caro process, utilize electrical energy to combine directly the atmospheric oxygen and nitrogen. This combination gives nitric acid which in presence of water and air in excess is transformed immediately to nitrous and nitric acid and finally into nitric acid only; this azotic acid is either sold as such or is led over limestone, giving as final product the nitrate of lime which is utilized in place of the Chili saltpeter or nitrate of soda for all agricultural uses.

**Nitrate of lime.**—Nitrate of lime was not at first received with favor by the farmers on account of its hygroscopic properties which demand the immediate use of the whole contents of a barrel once it has been opened. However, outside of this inconvenience, nitrate of soda and its consumption as a fertilizer has increased rapidly.

The manufacture of synthetic nitrate of lime has only been carried out so far in Norway by the Norwegian Nitrogen Company, and its subsidiary companies, grantees of the Birkeland and Eyde, and Schönherr patents.

The chemical fertilizers manufactured at Notodden are nitrates of lime, of potash, of ammonia, of phosphate of ammonia, and of biphosphate of lime; this industry produces also nitric acid and nitrate of soda. The production of nitrate of lime was 9,500 tons in 1909, 14,000 tons in 1911, rose to 50,000 tons in 1912, reached 110,000 tons during the year 1913, and it is estimated that the production in 1915 will be about 160,000 tons.

The Norwegian Nitrogen Company and its subsidiary companies have undertaken, solely for the needs of this industry, the construction of a number of hydro-electric plants, the total capacity of which will reach the enormous figure of 540,000 h.p. There are at present four plants of approximately 180,000 h.p. in operation, with two others totalling 160,000 h.p. in course of construction.

We have seen previously that the world's yearly consumption of nitrate of soda was approximately 2,500,000 tons; but the Chilean saltpeter is not utilized solely as a fertilizer, it is also employed in the manufacture of powder and nitric acid. The statistics of the different countries do not subdivide the consumption of saltpeter, but it is generally acknowledged that industry does not absorb more than 1/5 or 1/4 of the total production of nitrate of soda.

Mr. E. F. Cote, a well-known French economist and engineer, after having analyzed the progress of the different Norwegian industries in 1912, expressed the following opinion concerning the future of the manufacture of nitrate of lime:—

"Four hundred thousand horse-power with the efficiency mentioned above would probably produce 250,000 tons of nitrate. But what is this? Chili exports every year 2,000,000 tons of natural nitrate to Europe; in ten or fifteen years the Norwegian nitrate plants will have attained their full development; but their production then will not be sufficient to take care even of the increased consumption. It is certain on the other hand that the Chilean beds will not be able to indefinitely supply the rapid and continuous increase of the demand, and it will be necessary for industry to develop its own means of production in order to satisfy the urgent needs of nitrogen of the bread-eating nations. This means that the market for nitrogenized fertilizers is practically unlimited and that is why the capitalists have given their backing to the electro-synthetic processes with a spontaneousness which has only been equalled by their boldness."

Limestone is the only raw material required in the manufacture of nitrate of lime, the economical production of which is entirely dependent on the cost of the electrical energy. In Norway, the cost of production of nitrate of lime is very much below the selling price of Chili saltpeter.

**Nitric acid.**—Synthetic nitric acid is chiefly obtained by the Pauling process, which is similar in principle to the Birkeland & Eyde, and Schönherr processes. It would seem as if the grantees of the Birkeland and Schönherr patents had given greater attention to the manufacture of nitrates, whilst the owners of the Pauling rights produce nitric acid principally.

The Pauling furnaces are used in Austria-Hungary, at Patsch, near Innsbruck; there are twenty-four furnaces absorbing 15,000 h.p. Another plant of 8,000 h.p. operates the Pauling process in the north of Italy, whilst in France, the Roche-de-Rame works near Briançon, have utilized 8,000 h.p. since 1908, and will ultimately use 20,000 h.p.

Nitric acid manufactured synthetically is very pure, and is free from nitrous products, from chlorine and sulphuric acid. It is very superior to the general run of commercial acids as the ordinary preparation of it by nitrate of soda does not allow the entire removal of impurities. The by-product of this industry is nitrite of soda which is used in the manufacture of dyes.

The world's production of nitric acid is from 200,000 to 250,000 tons per year, Germany producing about 100,000 tons, and the United States 70,000 tons per year. The margin between the selling price of ordinary nitric acid and the cost of synthetic azotic acid is large and indicates that this industry can afford to pay more for its electrical energy than the nitrate plants.

**Calcium cyanamide.**—Calcium cyanamide, also called azotized lime, or nitrogenized lime, is an artificial fertilizer containing carbon, nitrogen and calcium.

Calcium cyanamide is manufactured in fifteen different plants located in France, Switzerland, Norway, Italy, Austria-Hungary and Japan. In addition, the American Cyanamide Company has important works in the State of Alabama, and a plant at Niagara Falls on the Canadian side.

The world's production in 1911 was 110,000 tons, in 1912 was 153,000 tons, and in 1913 reached 226,000 tons.

The Canadian plant began operation on the first of January, 1910, with a yearly capacity of 10,000 tons, and has been forced to raise its production to 12,000 tons in order to satisfy the demand of the American compost dealers. The directors were so satisfied with the results of the first enterprise that they decided to double the capacity of their works, and in March, 1913, the production of the plant had been increased to 24,000 tons per year.

## ELECTRO-METALLURGY

**Aluminum.**—Aluminum was the first metal manufactured in a hydro-electric plant. Its manufacture belongs to electro-chemistry on account of the electrolytic method employed, and to the electro-metallurgy on account of the nature of the product.

Aluminum is manufactured by electrolyzing alumina dissolved in a molten bath of cryolite, these materials being placed in an iron trough lined with carbon and connected to the negative pole of a dynamo while a carbon anode immersed in the charge is connected to the positive pole.

Since 1886, the increase in the world's consumption of aluminum has been phenomenal. The manufacture up to 1890 was in the hands of five companies who raised the production of aluminum from 175 tons per year to 7,300 tons during the period from 1870 to 1890. In those thirty years the average price of aluminum decreased from \$1.00 a pound to \$0.22 a pound in 1900.

The price of \$0.22 per pound did not leave a very great margin of profit, so that in 1900 the five companies amalgamated. The number of available horse-power per square mile is greater in some cases, but it is painful to realize that in the percentage of utilization, we are woefully behind the other nations.

In passing it may be interesting to note, at this par-



mated into an international syndicate to regulate the production and the selling price of aluminum.

This combine caused an immediate rise in the quotations, but in 1907, the patents for the manufacture of aluminum having become public property and the price of copper having fallen very low, the production of aluminum became much larger than the demand for it. This was followed by a crisis which brought about the dissolution of the aluminum syndicate in 1908.

In April, 1911, a new alliance was formed between the different manufacturers of aluminum. The object of this combine was to regulate the selling price, to put a stop to the cut-throat competition which existed since 1908, and to work for the constant enlargement of the market for aluminum.

The extraordinary low prices of aluminum have resulted in the popularizing of the use of the metal and the increase in its consumption in a remarkable manner, so that a return to normal conditions will leave the manufacturers who have been able to face the crisis with a market for their product definitely enlarged and continually increasing.

In 1912, the United States produced 18,000 tons of aluminum. France 13,000 tons, and Canada 9,000 tons.

In 1910 the total power used by aluminum works was over 320,000 h.p., of which 140,000 h.p. was developed in France.

The actual capacity of the plants of the Aluminum Company of America is 90,000 h.p. Moreover, this company has recently signed a contract with the Cedars Rapids Power Manufacturing Company for the purchase of 60,000 h.p. to be used at their Massena, N.Y., plant on the St. Lawrence. The Shawinigan Falls plant is the property of the Northern Aluminum Company, and has a capacity of 20,000 h.p. A French company, the Southern Aluminum Company, has started at Whitney, N.C., the construction of a hydro-electric plant of 70,000 h.p., with furnaces of the same capacity. The whole plant should be in operation by the beginning of 1915.

**Zinc, nickel and copper.**—Zinc, nickel and copper are also extracted from their ores by smelting in the electric furnace. The production of zinc by the electro-thermic process has been undertaken chiefly in Sweden and in Norway. The production at Trollhattan in Sweden in 1912 was 3,228 tons with eleven furnaces in operation. This plant is to be increased, and will have an ultimate capacity of seventeen furnaces of 1,000 h.p. each and eight furnaces of 500 h.p. each giving a total installed capacity of 21,000 h.p.

In Norway two plants produced a total of 4,000 tons of electric furnace zinc in 1910, 6,600 tons in 1911, and 8,900 tons in 1912.

Industrial reduction of nickel and copper ores by the electric furnace is not as yet an accomplished fact. Dr. Haanel, of the Canadian Department of Mines, and Heroult, the French inventor, who has specialized in electric furnace work, made some recent experiments at Sault Ste. Marie, which lead them to think that it would be possible in the very near future to obtain a commercial ferro-nickel pig by the electro-reducing process.

The Government of Chili has also been making extensive experiments in France on the industrial production of copper, and hopes to be able to effect a reduction of 75 per cent. in the cost of its production by means of the electric furnace.

#### ELECTRO-SIDERURGY

**Pig iron.**—For many centuries it has been usual to obtain pig iron by reducing in the blast-furnace charges of iron ore mixed with the proper quantity of fuel and flux.

The modern blast-furnace is the most perfect of all heat utilizers and has a thermal efficiency as high as 80 per cent. In order that electric-furnace pig iron may compete with pig iron produced in the ordinary blast-furnace, it is necessary to have electrical energy at a very low cost.

In 1906, the Canadian Government authorized Dr. Haanel

to experiment on the reduction of ore in the electric furnaces known at the time. Dr. Haanel installed at Sault Ste. Marie a Heroult furnace of 250 h.p. in which he made 150 meltings. The experiments at Sault Ste. Marie lasted only a few weeks, but they were followed by experiments in Sweden extending over several years. At Domnarfvet, the tests took place between 1907 and 1909, and were made with several small furnaces which had been invented by three Swedish engineers.

The Swedish Association of Iron Masters considered that the results of the operation of the Gronwall furnace were good enough to warrant the construction in 1910 of a complete experimental plant at Trollhattan near the government's hydro-electric plant. The Trollhattan experiments were continued until September, 1911, and were made in a furnace of 3,000 h.p. The new electric blast-furnace of Domnarfvet is of 12,000 h.p., and should produce 100 tons of pig iron per day.

Iron ores are smelted by the electro-thermic process in California, in Italy, in Norway and at many places in Sweden. The production of electric pig iron in this last country was 122 tons in 1900 against 8,900 tons in 1910 and 17,600 tons in 1912. The world's production in 1912 was approximately 25,000 tons.

The Noble Electric Steel Company of California has in operation three furnaces of a total capacity of 8,000 h.p. There are in Scandinavia twenty furnaces absorbing over 36,000 h.p.

**Ferros.**—The name "ferro" is used to designate special varieties of pig iron which are used as a final adjunct in the metallurgy of steel. These are ferro-manganese, ferro-silicon, ferro-chrome, ferro-molybdenum, ferro-tungsten and ferro-titanium. The pigs produced in the electric furnace are expensive products of high quality. In 1910, according to the statistics of "l'Industrie Minerale" the average value of ferros produced in the electric blast-furnace was \$21.00 per ton, whilst the ferros of the ordinary blast-furnace were sold at \$2.00 per ton.

**Ferro-silicon.**—Ferro-silicon is used in the converting of pig iron for the production of steel. The world's production is over 60,000 tons of ferro-silicon per year. Two Canadian companies manufacture this product: The Lake Superior Power Company, at Sault Ste. Marie, with an electric furnace of 250 h.p., and the Electric Metals Company at Welland operating four furnaces of a total capacity of 5,000 h.p.

**Ferro-titanium.**—The manufacture of ferro-titanium in the electric furnace is particularly interesting on account of the large deposits of titanium ore in the Province of Quebec. The United States' production of ferro-titanium for the year 1912 has been estimated at 3,763 tons and nearly 600,000 tons of titanium-treated steel have been manufactured, as against 400,000 tons in 1911.

**Steel.**—It is an acknowledged fact that the cost of producing ordinary pig iron in the electric furnace is so high that it is only in special cases that electric pig iron can successfully compete against pig iron smelted in the ordinary blast-furnace, but the same does not apply to steel produced by the electro-thermic process. The electric furnace used for the production of high and medium grade steel has so many advantages over the other furnaces that its general use appears absolutely certain in the very near future.

There are already more than one hundred and twenty furnaces in operation in the world, and the production of electric furnace steel has risen from 33,000 tons in 1908 to 175,000 tons in 1912. Germany has tripled her production since 1910, and in 1913 had in operation fifteen plants producing about 102,000 tons a year, placing her in the lead of the other countries. The United States, after having manufactured, in 1910, 52,000 tons, including the large quantity of electric furnace steel rails, is now awaiting the results of the use of these rails and is only turning out in the electric



furnace special high-grade steels to the amount of 18,000 tons annually.

The electric furnace is also extensively used for melting steel for castings.

### CONCLUSIONS

The different industries which have been enumerated absorb approximately one and a half million hydro-electric horse-power, and Canada's contribution to this enormous utilization of power is just about 3.5 per cent. of the total.

This paper can only be considered as a very brief survey of a very large field and it would be rash to attempt to draw from it any definite conclusions. It is evident that all the industries mentioned above would not be sure of success in Canada, and that every particular case should be studied with the utmost care before trying to attract the investing public.

A number of foreign engineers do not see a very rosy future for these industries in this country, and in order to guard us against an exaggerated optimism the following quotation is taken from an editorial by Mr. Robert Pitaval, a French civil and mining engineer.

"Our opinion, however, after having visited some of the Canadian plants is that the development of Canadian water-powers will take place very slowly. There are two centres of industry: Niagara Falls and Shawinigan Falls, the first being exceptional and unique in the world. It appears that outside of those two power sites it will be very difficult for a number of years to develop others. Everything is against it: the severity of a terribly cold and long winter causing the low-water period, and the consequent shut down of mills to extend for at least six months, the absence of means of transportation (railroads and highways), and the little enthusiasm shown by capitalists for these enterprises, notwithstanding the encouragement given by the Canadian Government. It is impossible to think of enlarging the Canadian works at Niagara Falls, the only place where this might have been done, now that the American and British Governments have agreed to limit the volume of water to be diverted so as to save the beauty of the fall."

"It seems, then, that Canada need not be considered as a serious competitor of the other countries rich in water-powers, or of the world's electro-chemical industry. The proof is in the failure of electro-siderurgy which had every possible chance to succeed in Canada."

More recently, Mr. Pitaval, returning from a visit to Niagara Falls, published the following comment:—

"This means that in the near future there will not be any extra energy available at Niagara, and that we know now the limit of capacity of the great electro-chemical works of this region. These works, situated along the road from Niagara to Buffalo or to Echota, on grounds bought by the Niagara Power Company for this very purpose, have reached their maximum capacity. The electro-chemical centre of Niagara, with a cost per horse-power year of \$15.00 on the average, with labor at \$3.00 per day, and with the legislative restrictions with regard to the water diversions, will never constitute a serious competitor for similar European plants. The situation at Niagara is far from being comparable with that of the Scandinavian plants which are much more advantageously located."

This opinion is also shared by Mr. Julien Dalemont, electrical engineer, and at one time a lecturer at McGill University. This gentleman writes as follows in the "Revue Economique Internationale" of December, 1909:—

"Besides the difficulties of operation of the hydro-electric plants, it is important to note also a factor which from the very beginning makes the success of these enterprises very doubtful. All the available falls with a few exceptions are low head falls with large discharge."

"There are now a few natural falls whose height exceeds 100 or 130 feet—even 325 feet—but all the artificial falls

created by diversions of rivers starting from the heads of rapids, are falls with a low head and a large discharge. Consequently the amounts of money permanently invested in the hydraulic construction and in the machinery are such that the economical return of the enterprise often tends to become precarious."

It seems as if Mr. Pitaval had shown chiefly the dark side of the situation. It is evident that he exaggerates the difficulty of winter operation and, moreover, the objections would apply to the Scandinavian countries as well as to Canada. The great advantage of the water-powers of Sweden and Norway is the remarkable height of their falls and the consequent smaller volume of water required for the same power. Referring to Mr. Dalemont's opinion, it is somewhat consoling to note that he claims to have applied the same criticism to the water-powers of Switzerland.

It would be possible on our navigable rivers to subdivide the cost of development between Navigation and Industry. This would so reduce the cost of the industrial part of development that the unit cost of these low-head hydro-electric plants might compare with the figures of the Scandinavian developments. This Government help has been given to several plants in Europe and America and explains in a measure the apparently low cost of some of their enterprises.

There is no getting away from the fact, however, that the criticism of the two foreign engineers is partly correct. We are in a measure handicapped and there are numerous obstacles, economical, educational and physical which interfere with the rapid development of our water-powers.

It is significant to note that the countries who have given to the technical study of their water-powers the greatest number of years have the highest percentage of utilization: Germany, the Scandinavian countries, France and Switzerland, for example, were the first countries in Europe to undertake the systematic study of their rivers and falls, and a glance at the third column of Table I. will show that these nations have now a greater return from their natural forces than the other countries.

It is only recently that such studies have been undertaken here. At present, the Canadian Public Works Department, the Department of the Interior, the Quebec Streams Commission, the Hydro-electric Power Commission of Ontario, and the Province of British Columbia, have undertaken the scientific discharge measurements of some of our rivers and have established gauges all over the country. There has been a vast improvement in this direction, but we were so far behind the other nations that unless our studies are considerably accelerated, we shall forever lag behind our competitors.

It is undeniable that to utilize a greater percentage of our hydraulic forces, we must interest the foreign capitalists. The Scandinavian works have been largely built by the investment of French and English money, and there are no reasons why we should not be able to obtain for our rising hydro-electric industries the financial support of our two mother-countries.

It is safe to say to-day, that through the lack of surveys, of discharge measurements and of gauge readings there are very few of our water falls which could be offered to overseas bankers. To convince these men we must be able to lay before their technical advisers, complete plans to enable them to make in their office a rough estimate of the first development costs; we must, moreover, show them discharge measurements and gauge readings covering a sufficient number of years to allow them to calculate with accuracy not only the minimum power available, but also the average power on which they could depend. The electro-chemical and electro-metallurgical industries require energy at such moderate rates that it would be impossible in most cases to bank on the lowest available power only. These industries must have the help of the periodical power to



lower the average cost of the energy utilized during the year.

The development of our water-powers has also been greatly handicapped by the difficulty in obtaining a clear title of ownership and by the uncommerciality of some of the clauses contained in Government leases.

It is undeniable that we need a separate water-power policy for each province. It seems to the writer, that so soon

as the ballot for the formation of Provincial Divisions of the Society has been favorably voted upon, these Divisions should appoint Committees whose duties would be to place before their respective Governments the views of engineers on this most important subject. This action could be considered as a very good form of publicity, and its results would certainly redound to the general welfare of Canada.

# Stimulating the Electric Vehicle Industry

## A Notable Convention of Enthusiastic Believers in the Future of the Electric—Splendid Operating Records Shown—Prejudice Disappearing

The convention of electric vehicle interests, under the auspices of the Electric Vehicle Association of America, recently held in Philadelphia, was the most important and best attended in the history of the association. The feeling was pretty generally expressed that the electric truck is gradually but surely coming to be recognized as the most efficient and economical method of transportation in the various lines of commercial work for which it is specially fitted. The speed craze, which is probably the biggest factor in the popularity of the gasoline car, is dying down, and people are satisfied that quite as much, and often a little more, can be put into the day's work by using the better controlled, more reliable electric car, even though they may not be capable of spurting on occasion to satisfy the whim of the driver. Economy of operation is also coming to be recognized as a part of the electric. When the car is stopped, so also are the operating expenses, and in many classes of work, such as delivery, the time of standing is in excess of the time of actual running.

Two big obstacles in the way of the electric car to date have been their cost and the lack of facilities for charging. At the present time, charging stations have been fairly well distributed in the larger cities and towns, so that this difficulty is practically removed; in the near future, as these facts become better known, and the points where charging can be taken care of are more fully advertised, the objection will doubtless disappear.

The other obstacle, the first cost of the electric, can only be reduced with increased sales. Up to the present time the manufacturer has attempted too many types of car rather than standardizing on one type to be produced at the least possible cost. We believe they are coming to realize that this has been a mistake and there are already very prominent signs of standardization. Along with this will come reduced cost, and, as a natural consequence, increased sales. These two latter factors are interdependent and each must work to the benefit of the other.

It is very doubtful if there is any real prejudice against the electric car today. One difficulty in the sales situation is that the business has not been sufficiently active and lucrative to justify an agent in devoting his entire attention to the electric car. As a result we generally find that the same agency sell both gas and electrics, and, as the salesman will most naturally follow the line of least resistance, and as he finds that the gas car is easier to sell usually, he concentrates his powers of salesmanship on it and the electric is neglected. These matters, however, are being adjusted, and we believe the time is not very far distant when the electric car will show very decided symptoms of coming into its own.

At the recent convention mentioned above, interesting addresses were delivered by Mr. J. H. McGraw on the subject of stimulating electric vehicle progress; by Mr. F. N. Carle, on the early development of the electric vehicle industry in America; by Mr. W. A. Manwaring, on the general use of the electric truck by central station companies; by

Mr. P. D. Wagoner, on the present status of the electric vehicle industry in Europe; and others.

Mr. Manwaring stated that a census taken a twelvemonth ago showed 86 central stations to be using a total of 971 electric vehicles, which number had undoubtedly been increased during the past year. He referred to the capacity of the different types of electric vehicle regarding their mileage and consumption, giving specific examples to show that the daily mileage was anywhere from 24 to 62 under normal conditions, and the kw.h. consumption per mile anywhere from 1.94 down to .39. Mr. Manwaring reviewed the specific case of a fleet of 11 one-ton trucks, which had been in continual service for nine years. The average yearly mileage of these eleven trucks during this period was 4,855 miles per truck with a maximum mileage of 7,017 and a minimum of 4,016. During the ninth year (1913), the average mileage per truck worked out at 5,136 miles, with a maximum showing of 7,756, which would indicate that the trucks are as efficient as they were nine years ago.

Mr. J. H. McGraw spoke encouragingly of the possibilities of installing new life into the electric vehicle business. Extracts from his address also follow:

### Stimulating Electric Vehicle Progress

"What can be done to invigorate the electric vehicle business? Two features of the problem which stand out boldly are the wealth possibilities for large development, and the abundant resources among those engaged in the business. Yet in spite of great possibilities there is evidence of sterility in the comparatively little progress made.

"If, therefore, we may be permitted to regard the present situation as unsatisfactory what are the causes? Aside from the generally depressed condition of business throughout the country, investigations indicate that there are three reasons for the slow growth:

"First, the novel character of the business, which, while it has brought large installations in the commercial field and successfully launched the passenger car, has been depended upon to carry the business to a point where exhaustion has set in.

"Second, those responsible for the administrative conduct of the business have done little in a constructive or creative way to open up new lines of endeavor in exploiting their product, and have depended too much upon the routine performance of subordinates.

"Third, defective collaboration from central station companies furnishing energy supply and which has been depended upon as an interlocking necessity, has not been received to the extent to which it must be exerted.

### Can be Corrected

"All these elements can be corrected and improved without superhuman effort or extraordinary revolutionary undertakings by simply applying to them such reasoning as will develop adequate comparison with progress made in other



lines of business, and by adopting principles which have been known to bring results.

"Taking up this first cause, we have a condition analogous to that which previously existed in nearly every other field of commercial endeavor where the introduction of new methods or of improved equipment became a problem. The same conditions obtained. Whether it was agricultural implements, railway equipment, sewing machines, telephones, safety razors, pianolas, newspapers, electric lighting or any of the myriad other refinements which have combined to improve our economic and social life, the same ebb and flow has been experienced; and in no case has substantial progress been accomplished until the impediments of novelty have been ruthlessly brushed aside by the stern and irresistible necessities of commercial enterprise.

"This is the case with the electric vehicle. It has hardly reached a transitory stage. It is not yet commercialized. We are still fondling it as a luxury, hesitating to put behind it that dynamic energy necessary to force it upon the public which does not know its value and which is waiting to be convinced that it must have it and use it in great numbers as an economic necessity.

#### Hard Work Needed

"Considering the second cause, it must be evident to every keen observer that the solution of most of the many difficult problems now left to the salesmen must be made by those justly responsible for administrative functions. The inclination to drift with the tide of things, and be satisfied with business that can be readily secured, without any effort to sift out and win by sheer merit the more difficult but more profitable undertakings, must be checked. The excuse that the business is new and that time is necessary to overcome obstacles is no more valid in this line than in others. On the contrary, the reward which awaits industry in this field is infinitely greater than that which falls to the lot of business projectors in other fields. However, these anticipated results will never be secured automatically. They can only be won when the strongest kind of administrative energy is directed against the obstacles involved.

"The present semblance of weakness must be entirely changed, and upon the administration must be laid the task of discovering, testing, and establishing those methods of organization and management by which all business productive energies may be united, stimulated, guided and rewarded. Then all the possibilities covered by the enormous scope of this industry may be forced to yield that increase in the application of electrical machines, which will transport the entire vehicular tonnage of freight, now moved within the city limits, as well as supply the latest demand for that immense passenger traffic of a domestic, professional or commercial character which only awaits an enforced recognition of the cheap, convenient facilities of the electric carriage.

"It requires but little observation to discover that the field has enormous scope. Every pound of material of any kind within the range of our vision in cities, excepting alone the original virgin soil and natural growths, has been moved at one time or another in some form of vehicle over the city streets. Every building has been carted in on wheels. All the vast equipment we make use of in any way whatever has been transported. In addition there is the enormous quantity of transitory merchandise, constituting our commerce, as well as our consumed materials; the sum total of which transportation might, and probably some day will, be performed electrically. This is a reasonable anticipation, just as in a comparatively short period in the past, similar transformation has taken place in the supply of light and passenger transportation by means generated and supplied by public service organizations.

#### Enormous City Business

"Some conception of this city vehicle load may be gained by reference to the volume of our transported materials in

other directions. The annual tonnage originating on railroads for the past eight years has averaged 800,000,000 tons. An equal amount was transferred to connecting railroads, thereby making the total annual rail tonnage over a billion and a half.

"It would be fair to assume that at least one-third of this finally reached our principal cities and was carried there at least twice over a distance of only one mile. We have a minimum of 1,000,000,000 ton-miles per annum.

"It is generally conceded that the freight tonnage reaching cities is handled many times over, but assuming as above that it was simply handled once from the railway to business premises and afterwards to the consumer, the above 1,000,000,000 ton-miles at an average energy consumption of 5 kw.-hrs. per ton-mile, would at the 4-cent rate reach a total figure of \$200,000,000 per annum.

"This equals very nearly the total gross income of all central stations now engaged in business in the United States and if this tonnage were handled for one additional mile the revenue would practically equal the total gross income of all electric railway organizations in the country.

"Now to consider the third cause. It may be well acknowledged that the attitude of the majority of central station organizations is favorable towards the advancement of electric vehicle projects, and that at least a half dozen of the larger ones are conducting organized departments for the advancement of vehicle use. Furthermore, all of them have liberally contributed to the funds of the general advertising campaign which has done such effective educational work in the past few years. However, it is equally plain that the central station effort is not at all in keeping with the enormous vehicle load which stands practically at its doors.

"I have indicated in what direction the salvation of the industry lies. We need to show the central stations of the country the great market offered by electric vehicles when they come into their own, and to induce them to preach their use in season and out of season as they do the use of lamps, motors and heating devices. Freight loads are larger than passenger loads and possess greater diversity. If, therefore, it is profitable to transport human beings electrically, how much more so would it be to transport freight; and if central stations are eager for railway loads, they should be even more keen to secure electric vehicle loads. I think they only need to be shown."

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Daily Consular and Trade Reports publish the following rates for electric energy in the city of Cork, Ireland:—

For lighting, 10 cents per unit, including supply and renewal of carbon filament lamps, with 2 cents and 4 cents per unit discount for certain amounts of consumption. For power, the rate is 4 cents per unit up to 1,000 units per quarter; 3 cents up to 2,400 units; 2½ cents up to 5,400 units; and 2¼ cents when over 5,400 units are consumed. The flat rate for cooking and heating is only 2 cents. Small rents are charged for meters. The voltage for lighting is 230; for power, 460.

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#### New Companies

The firm of B. Lefebvre, Limited, have been incorporated with a capital stock of \$50,000. The company will engage chiefly in municipal sewerage and roadway construction. The principal place of business will be located at Montreal.

Messrs. Stewart-Warner Speedometer Corporation, Limited, an extra-provincial company, has been registered in British Columbia with head office at London Building, 626 Pender Street West, Vancouver. The company will manufacture and deal in all kinds of engines, dynamos, pumps, etc., and will carry on business as mechanical and electrical engineers. Mr. David Gordon Marshall, Barrister, Vancouver, is the company's attorney.



# The Status of the Electrical Engineer

## The President of the American Institute Deplores the Lack of Consideration and Respect Accorded the Profession—Are Conditions Improving?

The president of the American Institute of Electrical Engineers each year delivers an address at the annual convention of the institute, dealing with some subject of current interest to the engineering profession. This year's president was Mr. C. O. Mailloux, and his subject, "The evolution of the Institute and of its members." The early part of the address dealt with the development and activity of the institute and its evolution; the latter part, with the social and civic evolution of the engineer. Mr. Mailloux discussed, in very interesting and forceful language, the value of the trained engineer in the social and civil life of to-day and pointed out regretfully that he was not, as a class, occupying the sphere for which his talents, education and training specially fitted him. The standing of the physician, lawyer and the clergyman is recognized, and his functions no longer usurped by the layman. One of the most common occurrences in the civic life of to-day, however, is the decision and management of important engineering problems by laymen with absolutely no knowledge of the matters in hand. Extracts from the latter part of Mr. Mailloux's address follow. They will be read with intense interest and concurred in universally by the engineering profession.

One of the important objects I have in mind, is to bring to the attention of electrical engineers—and, incidentally, to the attention of all other engineers or classes of engineers who are "in the same boat,"—the fact that the acquirement of what might be termed "technical adeptness and dexterity," either individually or collectively, by the members of a profession, and the resulting increase of technical knowledge, accumulation of experience and data, and development of engineering methods, do not constitute the summum bonum of our professional life, do not represent our only ideals or the sole end and purpose of our efforts, either in an individual or in a co-operative sense.

### Engineers too Self-Centred

In extending and improving our relations to each other, through our Institute, we have laid the foundations for the development of a great guild. Let us remember, however, that in this case we ourselves may not, indeed, we cannot, be the sole judges of greatness. In reality, it is not self-recognition, but recognition of a class by all other classes, that counts. This is a point to which engineers as a class have given altogether too little attention. They have been too self-conscious and self-centered; and they have not paid enough attention to their relations to the outside world. They have neglected to cultivate, and, consequently, they lack, the "guild-spirit,"—that force which makes for the increase of prestige, influence and power of the guild, and secures for it the greater respect and consideration of other guilds and classes. It is high time that engineers should appreciate the importance of "taking their place in the procession," in a social, civil, and civic sense. While, in a professional class, the prominence of individuals may depend only or mainly on professional technique and achievements, the prominence, reputation or caste of the class or clan, as a whole, depends mostly, perhaps wholly, on the professional spirit—the "esprit de corps"—and on the ability, of the guild or class, to hold its own with the other guilds and classes, on common grounds, in social, civic, political and other life, in the outer world. The next point of interest is that we really have duties to perform and are entitled to benefits, in that outer world. Moreover, our neglect to preempt or to occupy the place that belongs to us there, is a serious handicap to the

prestige or influence of our particular professional class, and places it in a condition of relative disparity, before the world, as compared with other professional classes—such as those of law, medicine, the fine arts, etc., which assert their rights and utilize their opportunities systematically.

When people speak of the "upper crust" of society, they imply and recognize, tacitly, the existence of lower layers, strata or classes in human society. It were indeed idle to deny the existence of classes, orders or groups in human society, any more than in the rest of nature. It seems to be in nature's general programme. We find classes in the infinitely great worlds of the astronomer, and we find them in the infinitely small worlds of the bacteriologist, and in that of the physicist; and we find them everywhere between these two extremes, in the animal, vegetable and mineral kingdoms. An interesting example of the stratification of life was noted by the Prince of Monaco in his deep sea explorations. He found that the ocean had upper and lower "layers," or "tiers" of inhabitants, with an indefinitely great number of intermediate layers; moreover each kind of life, indeed each species of fish or animalcule, has its place at a certain depth, where it is "at home," and above or below which it is "out of its element," and may be so uncomfortable or so handicapped that it cannot live.

In this entire system of stratification in the universe, the relative location of each layer may be the result of accident or circumstances, but it is always liable to change. In the case of the "layers" of human society, some important changes have been effected rather suddenly by revolution; but most of the changes occur by the slower and better process of evolution. The important principle of the "survival of the fittest" is always in operation here, for there is continual battling by contending forces, the weak being crushed or thrust aside by the strong. The social or civic level occupied by any class in human society is at the point of balance or equilibrium between its own efforts to rise to higher levels and the efforts of other classes to prevent them from rising in order to take their place.

It is my opinion, as it is also that of many of my colleagues who have given careful thought to the matter, that as a professional class, we are entitled to occupy a higher station and to receive greater consideration and respect than have been accorded us by the public. I will not deny that we have made considerable progress in the direction of social respectability and higher civil status. A recent review of the evolution of the engineer, in the London Times, contains the interesting statement that "Considerably less than a hundred years ago engineers in the navy took rank next below carpenters." It is most gratifying to realize that, in the present day, in all the navies of the world, the engineer is in the "officer" class and that, at least in our navy, many of them have attained the "Admiral" class.

### Rarely Have Final Authority

In an address on "the position of the engineer in civic and social life" presented before an Austrian technical society in 1877, one finds ample evidence that the civil and social status of the engineer were then far from satisfactory to the engineers themselves. There is lament over the fact that the older professional classes, which had hitherto divided the world amongst themselves, looked upon engineers as "upstarts" and "intruders." We may still be considered "intruders" by the lawyers and politicians who fill the positions that we engineers alone are qualified to fill properly on public



service, public works, and other commissions dealing mostly with engineering questions; but, at least, we are no longer called such harsh names. So we have made some progress—just enough, perhaps, to show how far we are still from where we ought to be. The following passage in the address is well worth quoting: "Only in rare, exceptional cases, do we see engineers, even in matters of specifically technical character, vested with the authority which gives the ultimate final decision; indeed, they are never in the majority in the deciding body." Further on, in the same address the statement is made that the final deciding power in matters of the kind already mentioned remains "in the hands of laymen, and that the preponderating majority is composed of amateurs generally having a pronounced legal 'tinge.'"

These remarks, thirty-seven years old, need practically no revision for presentation before an American engineering society to-day. They still report the conditions quite correctly. The author calls attention to the fact that the civil and social status of the engineer are higher in France and in England than in the German countries. The engineer has never been regarded and treated in the former countries as an "upstart" or an "intruder." Of the French engineer, the paper says that his education not only equips him with the necessary knowledge and preparation for the fulfillment of all his technical duties, but that it makes him, in general culture, good breeding and social tone, equal to members of all other social classes, and that he is, therefore, received and acknowledged as such without any opposition. This passage is interesting as evidence of the benefits attainable from the kind of training which supplements technical adeptness and dexterity by the development of personal character along intellectual, cultural, social, civic and ethical lines.

This plea for the proper recognition of engineers, as a professional class, though based upon justice, is, in a sense, a selfish one, and, in urging it too strongly, we might expose ourselves to the charge of being actuated by a desire to gratify professional pride or vanity. Fortunately, the real motive for the evolution of the engineer in social and civic directions is one that is quite altruistic, for the benefits which will result from it for the engineering profession will be trifling in comparison with the benefits to the community, to the state, and to humanity in general. This may seem to be a broad statement, but it can be demonstrated.

#### Need Citizen Engineers

We know that it is the engineer who, in the last hundred years, has effected the marvellous transformation in the material conditions of life and in the activity of communities which are startling to the historian, and which seem revolutionary to the superficial observer. The engineer has been too busy himself with the multifarious details of this gigantic task to note that what he has done has, in reality, reacted upon the whole structure of civilization to an extent so great that profound alterations, if not entire remodelling and reconstruction, are needed to restore balance and equilibrium. Now, in this task of industrial, social, economic, and political rearrangement and readjustment, there is work for all classes; and, considering the highly technical character of many of the problems involved, there is, especially, much work for which the training and experience of the engineer are important if not indispensable qualifications. It is here that we need the voice and authority of the citizen who is also an engineer; but his place is taken and his authority assumed by the lawyer, the politician, the agitator and the utopist, each having as little useful technical knowledge as the other, but each presuming, nevertheless, to be an expert and an authority on questions that are beyond his ken. Let us note here a significant fact. Public opinion holds so much consideration and has so much respect for the older professional classes—law, medicine and theology—that it would not tolerate the suggestion that the tribunals of justice should be administered

by others than jurists, that questions of sanitation or hygiene should be decided by others than medical men, or that moral questions should be settled by others than clergymen. When, however, it comes to questions involving scientific and engineering knowledge, public opinion seems to be satisfied to let them be discussed and settled by anybody whatever, preferably by others than engineers.

#### Science and Technical Knowledge

In older times, men could qualify for handling the problems of the civilization of their day without reference to technical science, as knowledge of law and religion was the fundamental requirement. A very little science went a long way in an age when sophistry and credulity were at a premium. As a result of the rapid progress of civilization along scientific lines, the importance of law and religion now sinks into insignificance, in comparison with science and technical knowledge as qualifications for dealing with the problems presented for solution. It does not require much thought or imagination to see that, in a society which is becoming daily more and more dependent upon science and engineering for its welfare and well-being, aye, for its very existence, there is more and more room and need for men of technical training at the helm in public affairs.

Some thirty years ago, the then president of these United States stated that "we are confronted by a condition, not a theory." To-day, we have a different state of affairs. We are confronted by both conditions and theories, more especially by a great number and variety of theories, many of them of questionable soundness. This conglomerate condition is owing to the fact that we have too many "quacks," and not enough "doctors," in economics.

A sage of by-gone times uttered the aphorism that there is no royal road to learning. Now, the world would not be so much disturbed or inconvenienced, if it were only royalty that aspired to acquire learning without having to pay the price. Unfortunately, that disposition has become epidemic at the present time, and what is still worse, the appearance is often accepted for the reality, so far as knowledge is concerned, more especially knowledge of civics and economics.

The framers of the constitution of the United States, in making a general statement that "all men are born free and equal," without making it clear that they meant freedom and equality in a civic and legal sense, rather than in a social or intellectual sense, left room for much misunderstanding and confusion. The untutored mind finds encouragement here for the notion that one man's opinion is as good as another's. He does not distinguish between the right to express an opinion, which is a matter of law, and the value and authority of that opinion, which are matters of knowledge. He forgets that while the right may not be disputed, the authority may be both disputed and denied. This self-constituted authority is a source of great mischief, and it is, perhaps, the indirect cause of much of our social unrest or political inconsistencies and our economic disturbances. We are forced to realize and to admit that it puts a premium on ignorance.

#### Not Possessed by Laymen

The same process of reasoning that makes a man think he is an authority on all political questions makes him a partisan of direct legislation in its most radical forms. Instead of matters being improved, they are made worse. The reason can readily be seen. The burdens thrown upon the individual increase in proportion with the responsibilities which he assumes. In presuming to deal with and pass upon all civic, economic and political questions directly, instead of delegating them to representatives, he assumes implicitly the responsibility for informing himself about every matter, and getting at least as intelligent a grasp and comprehension of it as the representative is presumed to have. But here is precisely where the trouble arises. Many of the questions which he has undertaken to answer for himself, in doing



away with representatives and proxies, and in becoming his own authority and guide, are questions involving and requiring more or less thought and study and inquiry into facts. It is work of a kind for which the average citizen has not the time or the inclination, even if he had the aptitude and the training. How can enlightened thought and opinion and rational action be realized under such circumstances? It seems natural to expect that most of the untutored and indifferent minds in the community will either jump at conclusions or arrive at them in a very superficial way, very much as one may try to get the news by merely reading the heavy headlines in a newspaper. In such a case, it is very important that the headlines should be set up by men who are intelligent, well informed and honest.

It is a momentous question which is asked when we inquire whither the untutored citizens, who constitute always such a large part of the whole mass, will turn to read these headlines, in their search for information; and the answer is far from reassuring. Some may read them in the sermon of a popular divine who is trying to fill the pews by observations on civics, economics, and other technical subjects of which he knows precious little. Others may read them in the speeches and harangues of agitators and fanatics, and no doubt many others find them in the corner saloons in the vaporings of some would-be sage, who, after finding inspiration at the bar, tries to imitate the sapient "Mr. Dooley" in solving the world's problems.

#### **Blind Leading the Blind**

The sum total, the net result, of all this dilettantism is a condition wherein the blind are leading the blind. All this confusion, and all the blundering which it entails, could be and may be avoided by putting men and things back into their proper places. In seeking for causes, we are brought face to face with important facts. First, the present disregard for knowledge and authority among the masses, and the transition from a state or condition where a few privileged professional classes or sects were the only ones who presumed and were permitted to think and pronounce on public questions, to a state where all classes and, in fact, all individuals, assume the right and authority to do so, are undoubtedly consequences of long-continued abuse of authority by those who presumed to be the oracles of the people, and made believe that they knew all about things which, in reality, they did not know. Second, it is mainly lack of scientific knowledge that has caused the old-time oracles to fall from grace in the popular estimation. The days when scientific facts could be over-riden and overshadowed by rhetoric and oratory, are passed. An ounce of technical knowledge is worth a ton of imagination, when it comes to handling scientific facts. The public lost confidence in its oracles because it found out, in time, that it is more important for statements to be true than to be merely plausible. Third, the public is not to blame for not having given to men of scientific training an opportunity to enlighten and advise it in matters of scientific fact and knowledge. The blame lies with the men of the scientific class themselves, for having allowed the public, as a body politic, to remain in ignorance of their very existence, to say nothing of their qualifications. It is unfortunately too true that the civil and social status of the professional engineer are far from being well defined in the mind of the general public. Indeed, there are indications that the scientific education, training, and experience of the professional engineer are very little understood and appreciated in the community. It is not strange, therefore, that the professional engineer should, by many, be regarded as merely a higher grade of skilled mechanic or artisan. To remedy this condition, steps should be taken to inaugurate and carry on a campaign of education of the public, with the object of acquainting it with the engineering class. It is time that

engineers should assert themselves as a class and let the public see that they satisfy very substantially the requirements of an intellectual class, and one of more than average grade, as well as of high civic character; that, as such, they are qualified to render important service to the community and to the state, and are entitled to recognition.

#### **Civic, Social and Ethical Service**

I wish, at this point, to make it plain and emphatic that the kinds of service and of recognition that I have in mind are not of political, but more of civic, social and ethical nature and character. I would be sorry to see any body of scientific men become a political force and acquire ambition for political power. It would be a lamentable waste and perversion of mental energy of high quality and development. In the beginning of this portion of my address I spoke of the development of the higher and better sides of human nature, and of the evolution of character along the lines of high-mindedness and refinement, as the path over which man can attain to the highest civic and social planes. It is my opinion that not only the engineering class is capable of this higher development, but that it can serve as a strong leaven to promote that development in the community. In a word, I believe that, just as engineering has helped materially to improve physical conditions, so the engineering class can help materially to improve civic, ethical, economic and even moral conditions, in modern life. The education, the training and the experience of the engineer fit him especially for such a mission. He has to deal less with fiction and more with facts than most men of other intellectual classes. He learns early to understand and appreciate the value and utility of scientific method and precision in his habits of thought and expression as well as in his work. He also learns early to distinguish between the classes of subjects with which he is competent to deal, and on which he may presume to speak authoritatively, and those classes of subjects which are not within his sphere or his scope, and in reference to which it would be absurd or even impertinent for him to pose as an authority. He knows that specialties in intellectual work arise from the limitations of individual mental aptitude and energy, and he is willing to concede that the specialist is likely to have more and better knowledge of a given subject than the amateur. He might presume to express an opinion on subjects involving scientific or technical facts; he would hesitate to express one on subjects involving scientific hypotheses or theories; and he would be quite reticent on subjects involving metaphysical considerations or speculations. The subjects of the class first mentioned may be presumed to be wholly within his sphere; those of the next class are likely to be only partly so; and those of the last class are, as a rule, entirely outside of his sphere. The man who has been taught and trained to exercise such discrimination and discretion is qualified for sane, sound, rational, logical, thinking; he is apt to be more careful and accurate in his statements; he usually says what he means and means what he says; and his opinions are bound to carry weight and receive consideration. They make an interesting contrast with those of the man who undertakes to cover all subjects with equal "fluency." It is well known that, as a rule, engineers and scientific men are more conservative in their statements than most men of the other educated and intellectual classes. This is the result of a better appreciation of the limitations of all human knowledge and of the importance of precision in thought and expression; it is, in a word, the result of better intellectual perspective and mental balance. These qualities are very valuable in the citizen, in the member of a community, as they are known to be in the engineer entrusted with important tasks. They only need to be known to be appreciated. They should enable the engineer to command the respect and receive the consideration of the general public, for they are bound to



place him on a high civic plane, and make him an exemplar for the rest of the community.

That is the position to which I would like to see the engineering class attain. The other educated intellectual classes have had their "inning,"—their opportunity. Ours is yet to come. Deserve success and you shall command it. We must deserve and we shall obtain the confidence of the community; and when we secure it we must retain it, by continuing to deserve it. The engineering class can scarcely expect to reach the goal at one bound. It must expect to attain the higher position to which it is entitled among the thinking and intellectual classes by successive stages. It should delay no longer, however, in making a start and in taking the first steps.

I have not by any means exhausted the subject. There is a great deal more to be said, but I shall be content if I have aroused your attention to the importance of not neglecting our evolution along social and civic lines, and beyond the purely technical and professional lines which we have hitherto looked upon too much as being our final goal and the highest realization of our ideals.

I will offer, by way of conclusion, some thoughts summing up the situation, which, I hope, will receive your careful consideration and will be borne in mind by you as having an important bearing upon the further evolution, in a civic and social sense, of the members of this Institute.

#### Some Suggestions

1. The Institute has made most satisfactory progress in the development of the activities and forces which conduce to its efficiency, which enhance its merits and enlarge its reputation as a forum for the discussion of questions and the study of problems in theoretical and applied electrical science. Its evolution in that sense and direction has been rapid and healthy; and it bids fair to continue to expand its sphere of usefulness.

II. The membership of the Institute, as a whole, has shown extraordinary devotion and loyalty to its interests, and a most edifying zeal in constant efforts to place it on a high plane among the engineering societies of the world.

III. The members of the Institute, as a class, have great respect for high professional ideals and ethics, and they have given enthusiastic and strong support to all movements and measures tending to their development in the Institute.

IV. The members of the Institute, in common with those in the other engineering societies in this country, have paid but little attention to the cultivation of professional ideals outside of the Institute.

V. As electrical men we have pre-empted and we hold a high position in that inner world which constitutes the engineering hierarchy. We have not attained the same high relative rank and position in the outer world, in civil and social life.

VI. In spite of the wonderful achievements which we have performed and the great contributions to the progress of civilization for which we deserve substantially the entire credit, we do not hold the place in the social scale that is commensurate with our professional attainments and our social qualifications.

VII. We have measured our weight and influence as a class by reference to what we think of each other, and by our mutual respect and consideration for each other, forgetting that our social position and status are determined wholly by what the outside world thinks of us, or the respect and consideration which it accords us, or which we demand and obtain from it.

VIII. The time has arrived when the members of the Institute should develop a class spirit through which a man in the engineering profession can attain to the place and high honor and consideration to which he is entitled among the other professional classes.

IX. We must show to the rest of the world that engineers are, by education, training, and experience, as well qualified as any professional class, to discuss, and deal with, public questions and problems, and that in the case of technical questions we are better qualified than are the other classes.

X. We not only fail in our duty to our professional class, but we also fall short of doing our full duty to the community, by remaining silent, in the social and civil background, and by hiding the important light which we are most able to shed on many public matters, by virtue of our scientific and technical training.

XI. We must dispel the popular notion that clergymen, lawyers, physicians, and literary people are still, as in bygone ages, the incarnation of civic wisdom and the epitome of social philosophy, or that they still constitute the only available source of intellectual "high potential" and the only dispensary of advanced thought and knowledge concerning the problems of civilization and human progress.

XII. The engineering class must take its place on a social plane parallel with that of the other professional classes, and must claim, in connection with technical matters within its province, the same consideration and deference to its opinions and decisions that are shown to the other classes under similar circumstances.

#### A New Ceiling Fixture with Pull Switch Attachment

An excellent type of ceiling fixture which can be used with direct lighting reflectors, has just been developed by the National X-Ray Reflector Company, Chicago. This new device is illustrated in Figs. 1 and 2. The unit is arranged with



Fig. 1.

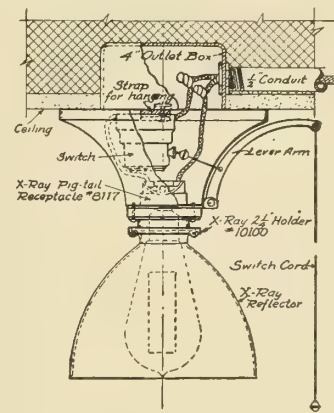


Fig. 2.

a strap for attaching to the lugs of a standard outlet box, or to a fixture stud, and is especially desirable for installation in shops, factories, work rooms, stores, garages, printing plants, power plants, kitchens, laundries, etc. It is approved and can be used without insulating joint. The unique and very desirable feature of this fixture is the switch and lever arm attachment, which enables the individual unit to be controlled independently of the other units on the circuit. The fixture can be obtained with or without the switch attachment. Three types of shade holders have been developed for use in connection with this ceiling fixture, the 2 1/4-in. form "O," 2 1/4-in. form "H," and 3 1/4-in. form "A." The interchangeability of parts makes it possible with this fixture, to cover all ordinary requirements as to lamp size, style of reflector and height of suspension.

Mr. G. J. Smith has been appointed electrical inspector of the city of St. Catharines.

Mr. R. F. Morkill, signal engineer of the Grand Trunk Railway, who joined the first Canadian contingent and was gazetted a lieutenant, is now engaged in important work in Europe for the Imperial authorities.



# Electric Railways

## Railway Companies Unduly Blamed for Electrolysis Troubles of the Past

Experimental work has recently been completed by E. H. Scofield and L. A. Stenger, respectively engineer and chemist of the Minneapolis Railway Company, which show that electrolytic corrosion can occur where there is no possibility of stray electric currents being the cause. This is a particularly interesting announcement in view of the charges so frequently made against railway companies that their stray currents are the cause of a large amount of the pitting and final destruction of underground metallic pipes of various sorts. These experimental results are given in detail in a current issue of the *Electric Railway Journal*, a resume of which we reproduce below.

The authors in their introduction call attention to the fact that corrosion occurs on steel, wrought iron, cast iron and lead, both in the form of uniform rusting or oxidation at the surface and as the more destructive pitting. The former is generally recognized as a simple chemical action, limited in its effect and not likely to destroy the metallic material. Pitting, however, is usually attributed to electrolysis and, when found in localities where electric railways operate, it has been the custom in the past to suppose that this action was the result of escaped return currents of such railway systems. The discovery of numerous cases of pitting where there was no possibility of the presence of electric currents in the earth originating from commercial electric circuits, led the authors to search for other causes. The investigations disclosed two classes of phenomena. The first affects metals containing more or less of impurities in their structure, such as cast or wrought iron or steel; the second deals with any metal, regardless of internal impurities, such as lead, which, from its peculiar chemical properties, is ordinarily regarded as non-corrosive; it is found that, when such metals are buried in two different soils, however, a corrosive action is set up.

### Impure Metals

It is well known that when impure metals are immersed in or subjected to the action of electrolytes, electric currents are set up. This fact has been advanced as an explanation of the damage done to many metals exposed to the atmosphere, but it appears to have slipped the attention of engineers in the past, that a corresponding effect may result when impure metals are exposed to or in contact with soils. Experiments performed by the authors of this paper, however, show that such a condition constitutes a more or less active electric battery, in which the current will continue to flow unless prevented by polarization, which, the experiments further show, does not take place. A typical experiment was to form a cell of two pieces of cast iron, the space between being filled with moist peaty soil. The two iron plates connected through a milliammeter and a voltmeter gave .004 amperes and .7 volts. These values remained practically constant as long as moisture was present. The authors conclude that the damage done by corrosion to a number of samples submitted for their inspection was fully accounted for on the basis of natural soil corrosion.

### Pure Metals in Different Soils

The condition that causes damage from corrosion of the second class arises from a combination of metal and two soils of different composition. This condition is based upon the fact that an electric current can be generated by contact of two solutions of different chemicals. The same condition is produced practically by bringing two soils in contact, one of which contains any soluble substance subject to chemical change. The current enters and leaves the metal, which acts as a convenient conductor in the proximity of the soil and produces corrosion where it leaves the metal.

To demonstrate this theory, electrodes of various metals were used. The cell was made up of two different types of soil in contact and a lead electrode, for example, was placed in each cell with the two electrodes connected through a voltmeter. A voltage was generated when the lead electrodes were in different soils, but not when they were in the same soils. From a number of tests with different metals and soils, the authors are able to sum up their conclusion as follows:—

"The corrosion results of these tests and the appearance of the specimens are such as to fully explain all observed phenomena usually attributed to electrolysis by ground leakage currents. The cast-iron samples, where corroded, were covered with a hard scale of red rust and soil. The pits in the cast iron were filled with carbon and black-iron oxide. The pitting was localized, the space between pits being but slightly corroded. The lead samples show the presence of both the gray and brown oxides. The line between corrosion and non-corrosion, where the metal was exposed to two kinds of soils, is sharply defined. Potential differences up to 1 volt were generated by placing different metals in contact with certain soils, or by placing two pieces of similar metal in contact with different soils."

## Annual Report on Poles and Ties

The Forestry Branch of the Department of the Interior, Ottawa, Ontario, have just issued their annual report on poles and cross ties used during the calendar year 1913. The statistics are divided into two groups, namely, (1) steam railways, telephone and telegraph companies; (2) electric railway, power and lighting companies.

The total number of poles purchased in 1913 was 534,592, as compared with 608,556 in 1912. White cedar still represents by far the largest number, being 264,267, though this is a decrease from 1912, when 378,369 were purchased. Spruce also shows a decrease as does also jack pine and balsam fir, the latter from 38,000 to 1,437. A slight increase is noted in the purchase of red cedar poles and a considerable increase in tamarac, from 36,158 to 115,517.

The number of poles purchased by electric railway, power and lighting companies amounted to 65,071, as compared with 58,996 in 1912. There was a decrease in white cedar poles, but a considerable increase in red cedar. A few tamarac, cypress and western larch are also represented in this year's list. The average price for 1913 was \$5.45, as compared with \$4.79 a year ago.

The number of cross ties purchased by electric railways



during 1913 was 391,223, as compared with 483,362 in 1912. The average value was 58 cents, as compared with 50 cents in the previous year. Of the total number, white cedar is still in the majority with 145,659, though this is a slight decrease from the previous year. Tamarac, hemlock, spruce, douglas fir and hard pine also showed decreases, especially noticeable in the case of douglas fir which dropped from 156,930 to 5,982. An increase is shown by red cedar from 25,000 to 95,000 and by jack pine from 25,616 to 66,954. Also by oak from 2,925 to 14,760. Western larch, beech and maple were represented for the first time by 2,512, 152, and 61 respectively.

About ten per cent. of the cross ties purchased by both the steam and electric railways were given a preservative treatment to retard decay. This is a recent development as is shown by the fact that in 1910 practically no ties were treated at all and that the amount of treated material has increased steadily since that time. The treatment under present market conditions is more profitable when applied to the harder and stronger woods which, when used untreated, would decay before the end of their mechanical life.

#### Basis of New Agreement

The mayor of Montreal has submitted the basis of a new agreement between the city and the Montreal Tramways Company. Several previous attempts have been made to come to terms, but nothing tangible has resulted. The present agreement does not expire until 1922, and the suggestion is that the term be extended so as to make it cover a period of thirty years. The company have long term franchises in certain outlying districts; these are to be surrendered in favor of the thirty years' franchise covering the entire city. The company are to make extensions in stated districts, and to pay half the cost of the removal of snow, \$12,000 per annum for street watering, and one-half the interest and sinking fund for work ordered by the Quebec Utilities Commission. The city undertakes to construct a rapid transit railway under St. Lawrence Boulevard, and similar lines if necessary, at other points, the company paying an annual rent equal to the interest paid by the city on the capital expenditure and to furnish the necessary equipment; during the last ten years of the contract the city is to receive one-half of the gross earnings of the subways after deducting the cost of maintenance and operation. The fare is not to exceed 5c, and after midnight to 6 a.m., 10c. The city will introduce a bill seeking the necessary authority, and also for the company to acquire the Mount Royal Park incline railway. The company are to be granted a franchise for an autobus service on certain streets, if the city have the power, while the company will also be given authority to carry on a ferry service between St. Helen's Island and the Montreal harbor. In the event of the city not expropriating the company's property at the end of thirty years the contract is extended in periods of ten years until expropriation takes place. It is proposed that the present percentage of receipts paid by the company shall be abolished, in view of the fact that the company under the arrangement proposed will be giving a five cent fare to certain outlying districts in place of the ten cents now charged. Mr. Herbert, one of the controllers, has prepared an alternative report in favor of an engineer making an examination of the entire transportation problem and also of the construction of subways, either by the company or by the city.

#### Asked to Vote Again

Newmarket town and Uxbridge township, the two municipalities in the hydro radial area that registered an adverse vote against the scheme, will be asked to take another vote upon the proposition. It is felt that the favorable votes recorded in the other municipalities will probably carry sufficient weight with the electors in these two municipalities to reverse the situation.

#### Safety First Corporation

The city of Montreal has decided to co-operate with the Montreal Tramways Company in the Safety First campaign inaugurated this year by Superintendent Gaboury. The chief of police is to work with Mr. Gaboury, and later a committee of civic officials is to be formed to study the entire question as it relates to Montreal. The chief of police has sent out thousands of circulars to holders of vehicle licenses, referring to the urgency of observing traffic regulations, and also making suggestions how to avoid accidents. Mr. Gaboury states that the number of accidents has been reduced as the outcome of the campaign earlier in the year.

#### Would Build Private Road

The Canada Wire & Cable Company and other Leasehold interests have offered to construct a car line in North Toronto, connecting with Mount Pleasant Road. This line would be used chiefly for transporting the employees of these companies, who live over towards Yonge Street. It is stated that the lines would be handed over to the city as soon as they could be operated as a part of the civic system.

#### New Books

**Electric Cooking, Heating and Cleaning.**—Manual of electricity written in the interests of home life by Maud Lancaster, and edited by E. W. Lancaster, A. M. I. C. E., M. I. E. E. American edition. Published by D. Van Nostrand Company, New York. This book endeavors to explain certain of the elements of electricity in such a way that the housewife may understand. It then proceeds to point out the advantages of the use of electricity in cooking, lighting, heating and cleaning in the home and school. A very complete list of domestic electric accessories is described, assisted by some 300 illustrations. So far as we know, this is the first book of its kind to appear on the market and should be a welcome addition to the library of every domestic household.

**Electrical Measurements.**—By A. J. Bushnell and A. G. Turnbull. American Technical Society, Chicago, publishers. Price \$1.00. A practical handbook covering the design and construction of measuring instruments and their use in the measuring of current, resistance and commercial power, with special reference to watt-hour and maximum demand meters. Practical presentation of the subject with excellent illustrations. This book will find a wide application among users of commercial power and among those who are interested in increasing their knowledge of electrical instruments; contains 170 pages.

**Practical Lessons in Electricity.**—by R. A. Millikan, Ph.D., F. B. Crocker, M.A.I.E.E., and John Mills, A. M. American Technical Society, Chicago, publishers. Price \$1.50. This is a simple presentation of fundamental electrical principles and their application to direct and alternating current problems. The book is specially adapted for the purpose of self instruction as well as being a manual of information for the experienced electrical worker. Splendidly illustrated and thoroughly up-to-date; 249 pages.

**Applied Electro-Chemistry & Welding.**—by Chas. F. Burgess, E.E., and Geo. W. Cravens, M.A.I.E.E. American Technical Society, Chicago, publishers. Price \$1.50. This is a practical treatise on commercial chemistry, the electric furnace, the manufacturing of ozone and nitrogen, high tension discharges, and the application of electric, gas and chemical welding to manufacturing and repair work. The book is written in a clear, readable style, designed for the layman as well as the trained engineer. A study of this volume should greatly widen the acquaintance of readers with this branch of industrial electricity and stimulate their interest in general scientific developments. Well illustrated; 215 pages.



# Illumination

## Illumination as a Safety Factor in Industrial Plants

By R. E. Simpson\*

From time to time we read in the technical press that 500,000 avoidable accidents occur in the United States every year, and that of this number approximately 25 per cent. are due, directly or indirectly, to inadequate illumination or improperly placed lighting units. To get proof of this statement in the form of statistics is almost impossible. Reports are issued annually by the labor bureaus of various states, and by the Federal government, containing tables giving the number and causes of various classes of accidents. The causes that are listed include the breaking of hoists, cranes, winches, and other machines, the bursting of grindstones and emery wheels, the improper use of circular saws, lathes, and presses, contact with mill gearing (shafts, pulleys, and belts), and persons falling or being struck by falling tools or other objects. Rarely, if ever, is poor illumination among the list of causes, although many of the reports mention poor illumination as an indirect or contributory cause. The paucity of statistics on the relation of illumination to accidents is responsible, in a measure, for the apathy of factory owners and managers toward their lighting conditions. A manager, upon noting that such and such a number of workmen were injured by unguarded gears, at a cost to the employer of so many dollars paid to the injured employee in the way of compensation or in the settlement of damage claims, is often led to see that his mill has adequate protective devices; but there is very little chance of his attention being directed to his lighting conditions by the statistics, and if it is true that 25 per cent. of the avoidable accidents are due to inadequate illumination, he is overlooking an exceedingly important item.

### Spotted Illumination

The following incident which recently came to the writer's attention illustrates the evils of "spotted illumination" and the danger to workmen if one of their number is afflicted with retinal asthenopia or temporary blindness, and shows how easy it is to overlook the real cause of an accident. Two men were at work in a shop lighted by electric incandescent lamps, equipped with obsolete tin reflectors suspended close to the work. The upper zone of the shop was in semi-darkness—a condition which became more pronounced to the workmen as they looked up from their work. Some sections of the machinery and floor were brightly lighted, while others were dim. In going to another part of the shop one of the men stumbled over a casting that was lying on the floor, and in an effort to save himself from falling he blindly put his hand on a belt-shifting rod which controlled the machine of another workman in the next row. This action threw over the belt and started the other machine. Fortunately no injury resulted, as the second workman had just finished a piece of work, and was engaged at the time in selecting another piece to put in his machine. It can readily be seen that a serious accident might have happened

if the second workman had been engaged in adjusting the work in his machine, as he would have been totally unprepared for the starting of the machine.

The two men had a wordy war, the first blaming the man who had left the casting on the floor, while the second workman accused the first one of stupidity. Neither of them, apparently, considered the fact that the first workman was demanding an extraordinary performance from his eyes. There was marked difference in the reflecting values of the two parts of the castings on which he had been working. One part was highly polished and had a high coefficient of reflection, while the other part was a dull iron-grey having a low reflecting value. The man's eye muscles had been under constant strain in an effort to adjust the pupillary opening to the light-reflecting conditions—the opening remaining relatively small, however, so long as the eyes were focused on the work. When he turned from his machine his eyes were compelled to adjust themselves to the change from a brightly lighted field of view to a dimly lighted one; and inasmuch as the eye muscles do not enlarge the pupillary opening as quickly as they contract it, he was laboring, for a time, under a serious handicap.

If the incident had had a serious ending, the newspapers would have reported the accident as due to a fellow workman accidentally moving a belt shifter and thus starting up his comrade's machine; but an impartial and well-informed jury would have given improper illumination as the cause.

To many persons this incident may seem trivial, and it would be so if it were an isolated case. There are hundreds of factories in this country where the lighting conditions are similar to those that prevailed in the case just cited, and these conditions are responsible, in the aggregate, for thousands of what might be termed potential accidents. The stage is all set and ready, and the frequency of accidents, or freedom from them, is largely a matter of chance, with the odds greatly in favor of the accidents. A little attention to the lighting details in these factories would materially reduce the chance of accidents, and would therefore reduce the number of them.

### Require Good General Lighting

From a safety standpoint, as well as from a general illuminating engineering standpoint, intense local lighting, as the sole means of providing artificial illumination in a factory, is undesirable. A minimum of two-tenths of a foot-candle should be provided in all parts of a factory where a moderate degree of local illumination is required. In plants where fine tool-work is done, and fine bench operations are carried on, so that intense local lighting is required, the minimum for general lighting should be one-half a foot-candle. This minimum is also essential in a shop filled with moving machinery, especially if the men are required to go from one part of the shop to another in the performance of their duties. Sharp contrasts between the intense local illumination increase the hazards, because the employees, on account of their inability to see clearly, are apt to trip over obstructions in their path, or become caught in the machines or belts.

It may seem to some that I am giving too much em-

\* Read before the Illuminating Engineering Society.



phasis to the subject of falls as a cause of accidents, but statistics show that this is not the case. The annual reports of the British factory inspectors show that for the year 1911 there were 379 fatal accidents caused by machinery moved by mechanical power, against 377 due to persons falling. The figures for 1912 are 382 and 419, respectively. Very few industries are exempt from accidents due to falls. They are most frequent in construction work and in shipbuilding, and in foundries and iron and steel rolling mills—industries in which poor illumination is notorious. Poor lighting on stairways and in passageways and aisles in shops is responsible for quite a fraction of these accidents. In many cases the working area in a shop is well lighted, while no provision whatever is made for lighting the stairways and passageways. There is no work done in these places, and for that reason it does not occur to the owner that they should be lighted. The steps of the stairways are generally dark-colored and worn round at the edges—conditions which increase the hazard. Substantial rail guards and stair treads, and lighting units with proper reflectors, should be part of the equipment of every stairway.

#### **Danger Points Without Lights**

During a recent inspection the following conditions were noted. A 12-step stairway at one end of a room led from the basement to the first floor. The nearest lighting unit in the basement (an unshaded carbon lamp) was 35 feet from the foot of the stairs, and the nearest unit at the top was 20 feet away, a shadow being cast at the top by a post between this unit and the top step. An unguarded driving belt, extending half-way over the stairs, ran parallel to the stairway at a height of 5 feet 7 inches. The belt was operated so that the turn on the under side ran down with the stairs. A person coming in contact with the belt would receive an impetus sufficient to hurl him to the bottom of the stairs, causing him serious or even fatal injury. The belt should have been equipped with a guard painted white, and adequate light should have been provided so that anyone could clearly see the guard and the steps. When this was pointed out to the manager he agreed that these precautions should be taken, confessing at the same time that the danger had not occurred to him.

This brings out the point that making the general working conditions safer is often a matter of looking into the details of the lighting situation. The shop engineer and manager will generally give heed to the cost of installing, the cost of operation and maintenance, and the location of the lighting units, in the shop where work is performed; but the stairways and passageways, if considered at all, are provided with a lamp here and a lamp there, without due regard to the demands of safety.

In the shipbuilding trade a large percentage of the accidents that occur are caused by falls, and of this percentage the lack of proper lighting facilities is the greatest single factor. When a ship is building or being repaired, artificial lighting must be depended on, all the time, in almost every part of the ship. Generally speaking, adequate light is provided at the points where work is performed, but the lighting facilities from the working point through the ship to the shore are sadly neglected. The opportunities for falls are numerous, especially when the ship is being fitted out after launching. Open hatches, uncompleted and unguarded stairways, and gangways seldom, if ever, sufficiently lighted, are directly responsible for many serious and fatal injuries. If ship owners or builders would go to the slight expense of providing guard rails about stairways, platforms, bunker hatches, and openings into the hold, and see that these points are well lighted, the accident rate would be materially reduced.

Few of our large buildings have been erected without a certain number of the workmen being more or less seriously

injured. We are all familiar with the appearance of a building under construction—the street protection, the piles of building material, the single-plank walks over the beam layers and the uneven and unfinished floors, and the gloomy appearance of the first floor in particular. Building material such as bricks, sand, and cement, must be taken by hand from the point of delivery into the building, and the foremen usually drive the men so that the delivery wagon and the materials brought by it will obstruct street traffic as little as possible. A very limited number of lighting units are installed, in a more or less haphazard way, and these are depended on to light the working space and its numerous danger points. When the building is finished and the dangerous places have been eliminated, the amount of illumination is increased many fold. This, of course, is not at all consistent. The lighting facilities should be just as good during construction as after. Workmen carrying building materials are continually going from the bright daylight into the poorly lighted building, where they are unable to see their way clearly because of the great contrast in the lighting conditions; and this, together with the uncertain footing, greatly increases the hazards of their work, and is directly responsible for many accidents.

A great deal has been written and said in recent years respecting the merits, especially in the way of efficiency, of various kinds of lighting units. Salesmen have besieged factory owners and managers, the daily press and technical journals have been flooded with advertising literature, and bulletins have been spread broadcast, all for the purpose of bringing about a substitution of the more efficient units for the old, inefficient ones. The success of these campaigns is attested by the remarkable increase in the sales of the tungsten filament lamps, at the expense of the carbon and gem filament lamps. It is true that the introduction of the tungsten filament lamp has increased the degree of illumination in our factories and is an important item in the conservation of our resources; but I am of the opinion that it is equally true that the introduction of the tungsten filament lamp is the largest single factor for the increase of accidents in our industries during the period of artificial lighting.

The factory managers have gradually recognized the saving effected by the use of tungsten filament lamps. They have purchased them in large quantities, and have fatuously believed that by simply unscrewing a carbon or gem lamp from the socket and replacing it with a tungsten filament lamp of higher candle-power, of greater brilliancy, but consuming less energy, they have bettered the working conditions of their employees and made a certain saving in their lighting bill at the same time. If the old lamp had a shallow, obsolete reflector, this reflector was left in place—not even the dust and dirt on it being disturbed. If no reflectors were in use, new, up-to-date ones were seldom purchased at the time of the change in lamps. The manager noted the reduced lighting bill, and may or may not have noted the increase in the number of accidents. Assuming that he did consider this item, an admonitory notice recommending more care and vigilance may have been issued, and not much thought given as to the cause of the increase in accidents.

#### **Over-Illumination is Bad**

It is well known among engineers that the rays of light coming directly from a light-source into the eye reduces the efficiency of the eye as a piece of visual apparatus. It is axiomatic that if a man cannot see his danger he is more apt to be injured than he would be if the danger were evident. An unshaded carbon filament lamp, directly in the line of vision, has a certain deleterious effect on the workman's rate of production and on his safety; and if for this carbon filament a tungsten filament lamp with an intrinsic brilliancy two or three times as great be substituted, a slight increase in the



quality and quantity of product may be evident, but this is gained at a considerable reduction in the factor of safety.

A 100-mile journey along a trunk line through a thickly settled territory would make a vivid impression on a person acquainted with the principles of illumination. The factories along the right-of-way give the impression of being well lighted—and so they are, if judged by the aggregate candle-power emitted by the light sources. A close observer would note, however, that many of the principles of good illumination are violated. There seems to be a decided lack of attention paid to the details of mounting-height, spacing, and reflector equipment, all of which have an important relation to the effective illumination. A good-sized reflector factory would have all the business it could handle for some time to come in equipping the factories between Hartford and New York with reflectors.

Just prior to an inspection the superintendent told the writer that his mill was well lighted, and several times during our walk through the mill he complimented himself on the good illumination. There was one tungsten filament lamp, 150-watt size, suspended 7 feet 6 inches from the floor in one part of the room, just in front of a cutting machine. It was a clear lamp and the only one in the entire establishment with the dignity of a reflector, the reflector in this case consisting of a shallow piece of opal glass, 6 inches in diameter. The rest of the lighting equipment consisted of 16 candle-



Fig. 1—Sacred Heart Convent, Vancouver, B.C.

power and 32 candle-power carbon lamps without reflectors, a few of them suspended 7 feet from the floor, but most of them from 5 to 6 feet. It required less than five minutes conversation in the superintendent's office to show him the waste in using carbon lamps, and the greater safety and comfort of the employees and better lighted working space from the use of tungsten lamps equipped with modern reflectors and with the whole unit properly placed.

There is a crying need for a greater concentration of effort for the protection of the ultimate consumer of light, the eyes. Engineers and chemists have evolved lighting units, which if properly applied, will produce adequate illumination in our factories at a cost so slight that it is all out of proportion to its importance. The real problem seems to be the scarcity of men who are qualified to deal with the subject, and who can devote their time to it. There is a field for many times more men than are now available. The "Safety First" movement, and the recently enacted compensation laws, are creating a demand for expert advice on all matters pertaining to safety and sanitation, and the subject of proper lighting is bound to receive greater attention from factory owners than heretofore. It is here that the services of the illuminating engineer will be in demand, and in dealing with the problems he should bear in mind that one of the principal safeguards for any workman is unimpaired vision.

## Typical Semi-Indirect Lighting—The Importance of Proper Installation

Many installations of semi-indirect lighting have proven failures through a certain carelessness in the installation of the system. Like any other system, if not properly installed the results will not be satisfactory. Many people labor under the mistaken idea that to take any sort of a bowl or dish made of glass or other reflecting or diffusing material, suspend this with a few chains and enclose a few lamps, is



Fig. 2—Mason & Risch Piano Co., Vancouver, B.C.

productive of semi-indirect lighting. Any installation planned so carelessly would necessarily be a failure.

We are showing in the illustrations accompanying this article several installations which have been carefully planned and in which the results are pleasing and effective.

Primarily, attention has been given to the requirements of the particular room to be illuminated. The next step is to determine the amount of light necessary to carry on the particular work to be done in that room. After having found the approximate intensity of light necessary, the next step is the selection of a reflector which will make the best use of the light produced. By far the most important point in



Fig. 3—Toronto Public Library, Toronto.

this is to select a bowl or shade of proper curvature to send the light where it is needed. Glass manufacturers have produced quite a variety of designs so that a selection in harmony with the other decorations in the room can be easily taken care of.

The position of the lamp inside the reflectors is important; likewise the hanging heights; hence it is not safe for the ordinary layman to try to get results from semi-indirect



illumination, but it is necessary to consult the services of an Illuminating Engineer or some one familiar with the conditions necessary to produce good results in this way.

Fig. 1 illustrates an installation of semi-indirect lighting in the Sacred Heart Convent, Vancouver, B.C. (architect C. D. Badgley). Here, pressed Alba hemispheres are used and mounted in an appropriate band and in harmony with the decorations in the church. The result is a uniform distribution of light, and an artistic fixture, simple and consistent with the spirit of the building.

Fig. 2 illustrates an attractive lighting equipment in the show room of the Mason & Risch Piano Company, Vancouver, B.C. (Messrs. Parr, Mackenzie & Day, architects). A more elaborate bowl is used here, likewise an elaborate mounting. Attention is also called to the semi-indirect bowl on the bracket to the right of the illustration. The selection of glass and fixtures is consistent with the decorations of this very beautiful sales room.

Much thought was given to the selection of fixtures and lighting equipment for the Toronto Public Library and after



Fig. 4—St. Joseph's Hospital, Vancouver, B.C.

many experiments the lighting as shown in Fig. 3 was adopted. In this particular room photographs and prints are shown and the general effect is cheerful and comfortable (Wickson, Gregg & Chapman, architects).

Good results have been obtained by the use of some of the regular direct reflectors inverted. While as a rule it is not suggested that a direct reflector turned upside down will answer for semi-indirect illumination, an exception has been found in the use of one or two designs of tungsten reflectors with the use of a harp arrangement, or a four-armed fixture. Attention is called to Fig. 4, which shows the lighting of the corridors in the St. Joseph's Hospital, Vancouver, B.C. A very simple fixture is used here with the harp arrangement. One hundred watt Alba shades are used with very good results. The fixture is simple, sanitary and adequate for the purpose intended.

An interesting installation of a similar nature is shown in Fig. 5, which illustrates the lighting equipment used in the Imperial Life Assurance Company's offices, Toronto,

Ont. One hundred watt direct reflectors, inverted here also, produce a very efficient lighting equipment. There are no strong shadows but a uniform illumination throughout the room, which makes working easier, prevents eye-strain and fatigue, headaches and nervous exhaustion.

Another novel installation of Alba glass is in the Orpheum Theatre, Vancouver, B.C. (Jas. J. Donellan, architect). See Fig. 6. Bowls used as plaques on the parquet boxes and



Fig. 5—Imperial Life Assurance, Toronto, Ont.

the acorn shaped diffusing globes complete the decorator's scheme and illuminate the ceiling and upper walls.

Many mistakes are made in the installation of lighting equipment; some by the use of too much light; some by a too elaborate fixture; some by insufficient light; some by unsightly fixtures.

Engineers and interior decorators have agreed and concluded that the successful lighting equipment is that which produces sufficient light at moderate cost in harmony with interior decorations but at the same time is not so con-



Fig. 6—Orpheum Theatre, Vancouver, B.C.

spicuous as to be specially attractive itself. There is a subtlety in good lighting which when correctly installed produces comfort without the cause being too evident.

Provision is made in the budget of the lighting department of the Montreal Council for an expenditure of \$50,000 for the improved lighting of St. Catherine and Bleury Streets. It is also proposed to spend \$92,000 on a new police alarm signal system, designed by Mr. A. Parent, civic lighting superintendent. A feature of this is the deposit of numbered keys with responsible citizens, who will thus be able to ring for aid in case of necessity.



# The Dealer and Contractor

## Electric Gifts Most Appropriate

A number of further illustrative cuts of electrical equipment suitable for Christmas gifts and which reached us too late for our November 15th issue are shown herewith.

Fig. 74 represents an automatic electric stove oven manufactured by the Berkeley Electric Cooker Company, Berkeley, Calif., known as the Sav-R steam oven. This stove is cylindrical in design, enclosing a copper receptacle for aluminium vessels. This cylinder is well insulated for storing the heat. The copper receptacle is made of two copper jackets, between which is contained a quantity of water and a hollow space from which the air has been drawn, leaving a partial vacuum. With the application of electricity, the water is converted into steam, this operation beginning at about 68 degrees. This steam fills the entire enclosure surrounding the cooking vessels. It is claimed that the temperature of this steam is easily regulated, and that the quantity of electricity used is very small.

Fig. 75 illustrates a twin toaster by Landers, Frary & Clark, New Britain, Conn. It is claimed that toasting bread with this equipment can be done in much less time and at less expense than toasting over an ordinary fire. This is a very reasonable contention, when we consider the time and fuel wasted in an ordinary coal range over the making of a piece of toast.

Fig. 76 shows a general utility motor manufactured by

the Fidelity Electric Company, Lancaster, Pa., and operating, in this instance, a sewing machine. This is one of the most acceptable presents a housewife could receive at this season of the year.

Fig. 77 illustrates the well-known Dumore motor of the



Fig. 74—Electric-Steam Cooker—Berkeley Electric Cooker Company, Berkeley, Cal.

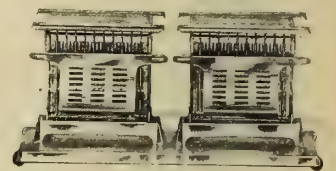


Fig. 75—Twin Toaster—Landers, Frary & Clark, New Britain, Conn.



Fig. 76 Sewing Machine Motor—Fidelity Electric Company, Lancaster, Pa.



Fig. 77—Dumore Sewing Machine Motor—Wisconsin Electric Company, Racine, Wis.

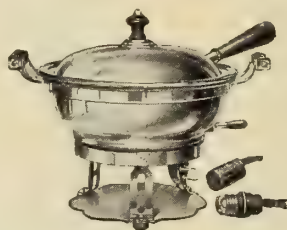


Fig. 78—Chafing Dish—Simplex Electric Heating Co., Cambridge, Mass.



Fig. 79—Coffee Urn—Simplex Electric Heating Company, Cambridge, Mass.



Fig. 80—Coffee Urn—Landers, Frary and Clark, New Britain, Conn.



Fig. 81—Sad Iron—Landers, Frary and Clark, New Britain, Conn.



Fig. 82—Electric-Steam Cooker—Berkeley Electric Cooker Company, Berkeley, Cal.

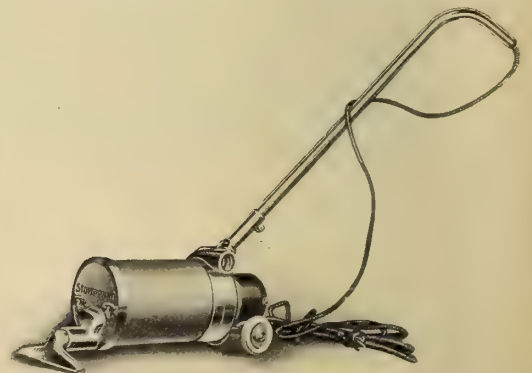


Fig. 83—Portable Vacuum Cleaner—B. F. Sturtevant Company, Boston, Mass.



Wisconsin Electric Company, Racine, Wis. This machine will operate on d.c. or a.c., 104-125 volts, 60 cycles or under, and is claimed to have eliminated in its construction the majority of the objectionable features of the earlier types of small motor.

Fig. 78 is another form of chafing dish. This type is manufactured by the Simplex Electric Heating Company, of Cambridge, Mass. Fig. 79 represents a household size of coffee urn, also manufactured by the Simplex Company.

Fig. 80 is a very handsome design, colonial pattern, of coffee urn, in suitable size for the home, manufactured by Landers, Frary and Clark, New Britain, Conn. Fig. 81 represents the Universal Thermo-cell sad iron, also manufactured by Landers, Frary and Clark. This iron is made with a special appliance for heating curling tongs.

Fig. 82 is another type of electric cooker manufactured by the Berkeley Electric Cooker Company, Berkeley, Cal.

Fig. 83 is the well-known Sturtevant portable cleaner. It is widely used throughout Canadian territory, where its excellent merits have long been recognized.

### New Line of Magnetic Switches

A new line of magnetic switches has recently been introduced by the Cutler-Hammer Manufacturing Company, of Milwaukee. The magnetic lockout switch is a type of series wound accelerating switch that has a number of features claimed to be of particular advantage and importance. The sealing pull, and consequently, the contact pressures of earlier types of series-wound switches are limited because a part of their magnetic circuit is necessarily of restricted area. As the new magnetic lock-out switch has no such restricted area in its magnetic circuit the sealing pull is equal to that of

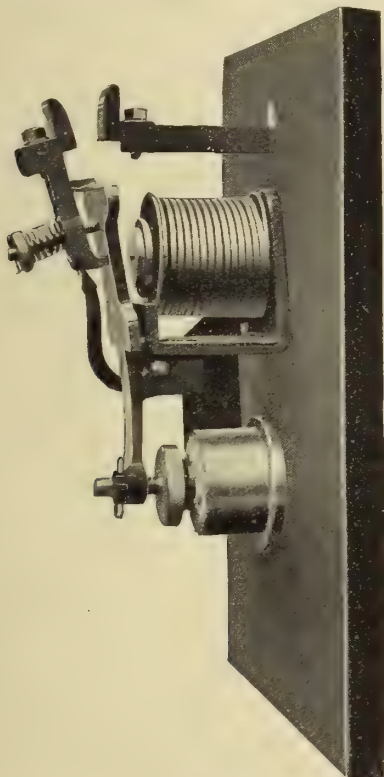


Fig. 1—New Cutler-Hammer magnetic lock-out switch.

the shunt coil operated switch of the same capacity thus permitting higher contact pressures and greater "follow-up" on contacts to allow for wear. Tests made to determine the relative contact pressures of these new magnetic lock-out switches and the single coil series switches of the restricted area type showed that that of the former was 60 per cent. greater than that of the latter. The Cutler-Hammer mag-

netic lock-out switch has the characteristic of remaining open when the current passing through its windings exceeds a pre-determined and adjustable value, and when the current falls below this value the switches close. The same contacts, the same "follow-up" and the same auxiliary contacts are used as are employed on shunt coil operated magnetic switches of the same capacity, a feature heretofore not to

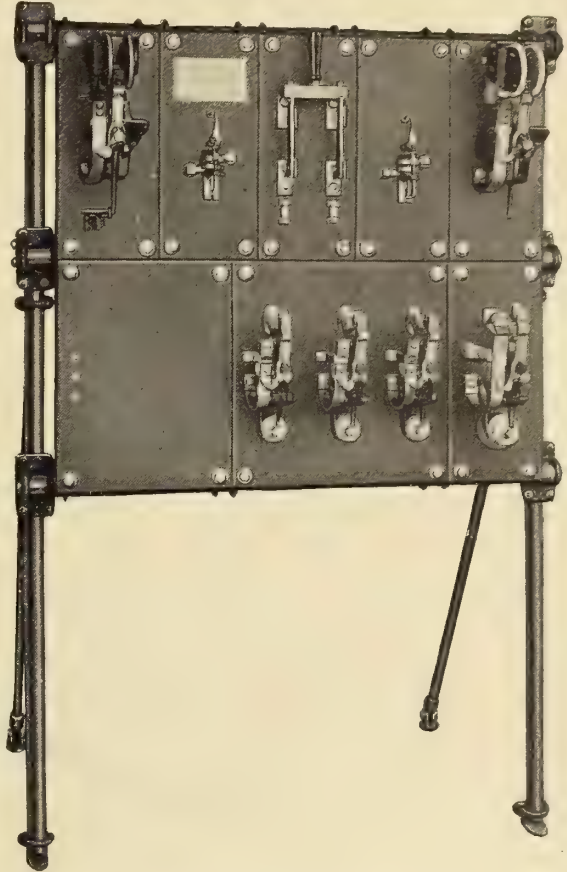


Fig. 2—The four accelerating switches mounted on the lower part of this 75 h.p. 230 volt D.C. panel are of the new magnetic lock-out type.

be found in other lines of switches. On the 100 ampere switches, the arcing contacts are also the current carrying contacts. For the larger size switches laminated brush contacts carry the current, and auxiliary arcing contacts are provided.

The construction of this line of magnetic switches is of the clapper form. The series-wound operating coil of the magnetic lock-out switches is divided into two parts, the upper bar wound, and the lower consisting of copper and asbestos ribbon. The upper section of the coil tends to close the switch and the other to hold it open. These switches are made up as single units, and numbers can be assembled according to the number of steps of resistance used in the motor circuit in starting. The illustration, figure 2, shows four of these accelerating switches on a 75 h.p., 230 volt panel. Cutler-Hammer d.c. magnetic switches that have been furnished for the past several years have been of the clapper type in the smaller sizes, while the larger sizes have been of the contactor type. At the time of bringing out these new magnetic lock-out switches, the shunt switches were re-designed so as to make them all of the clapper type. The advantages of the clapper type switches lie in its greater arc-rupturing capacity, longer life of the contacts, more rapid operation, easier access to parts subject to inspection and repair, and the possibility of interchanging parts with the magnetic lock-out type switches. The new line of magnetic switches is made in 11 sizes and types ranging in capacities from 50 to 3600 amperes.



## Increase Your Christmas Trade

Every electrical dealer and central station manager in Canada should be using super-human efforts these days, devising ways and means of bringing the Christmas purchasing business his way. People everywhere are going to buy presents as they always have done. If there will be any difference this year it will be in favor of the electrical gift—for practical ideas will rule. What are you doing to direct buying to your store? You see how the various other retailers are straining every nerve to get the crowd and their money. Are you a willing onlooker or are you in the race yourself?

There are both useless and effective methods of going after this business (generally about equally expensive) and we take the liberty of suggesting one or two that we know have proven very effective; and we believe will do so again many times during the next month. The man who uses the most effective means will be the man who gets more business. The others will get less. Are you going to get more or less than a year ago?

A prospective purchaser of Christmas gifts, in a fair sized Ontario town, who receives numerous letters during the day, was recently the recipient of one outlined with an attractive, suggestive, Christmas border of holly and poinsettia in green, black and red. He paid no special attention to it at first, but during the morning its brightness attracted his eye again so that he singled it out from the pile and read it a second time. During the day he did this instinctively a number of times and he showed it to the various men and women in the store. Finally he folded it up carefully and carried it home to show the members of his household, for the matter of the letter referred to the purchase of Christmas presents suitable for the home.

See what this one letter had accomplished. It had reached every member of the store's staff. It had also reached one household in person and started favorable comment, at least, in a number of others. It had started all these people thinking along the line suggested in the letter, namely, "make your Christmas present selections from the electric store." In the minds of all these people the idea of household electrical appliances was inseparably associated with a merry, bright, happy Christmas. Electric radiators were radiating good cheer, electric kettles were singing the song of the Cricket on the Hearth, percolators and samovars were diffusing the fragrance of the holly and the mistletoe.

That was good advertising.

A similar idea, not so effective, but still by comparison with the ordinary letter a very satisfactory means of attracting attention, is the use of a Christmas stamp bordered in holly or something equally appropriate. This, of course, lacks the attractive color effects that may be had on prepared letter paper, but colored ink may be used to relieve the dullness of the body of the letter. Another suggestion is to use red ink.

Having attracted the reader then with some such idea as one of those mentioned above, it remains now to drive home the value of electrical devices as Christmas presents by a well worded, comprehensive, convincing letter setting forth their claims for attention. Their general utility, moderate cost, attractive appearance, long life, suitability for every man, woman and child of whatever age or whatever circumstances in life should be pointed out. Invite inspection and before they come, make sure that you have the most attractive display in town (which is easily possible, as electrical equipment lends itself admirably for decorative purposes). When your visitors arrive ensure them proper demonstration and make them comfortable and in as far as possible, happy so they will associate these qualities with electrical goods. Send them away convinced, as you can, that nothing else combines, in such a high grade, the qualities of usefulness, luxuriousness and general attractiveness.

Merely as a suggestion, we are reproducing a sample letter herewith and such a letter as, changed to suit local requirements and tastes, would, we believe, prove a splendid business getter this season. Try it. Remember that Christmas buying is a big order. Dealers in other lines have found it well worth while going after, stronger and stronger, each year. It is time the electrical gift should take the prominent place in Christmas buying that it justly deserves. It will if you do your share. Incidentally you will reap the benefit in a nice little addition to your Christmas income.

## Licensing Electrical Contractors

The Hydro-electric Power Commission of Ontario are moving in the right direction, in that they are taking steps to ascertain the consensus of opinion among people now engaged in electrical work as to the advisability of introducing legislation requiring that only licensed electricians shall install wiring, and that only approved material shall be sold.

At the present time the man who requires an electrical installation of any kind is greatly handicapped in making his choice of an electrician. He probably realizes that there are good and bad as in all other lines, but he has no basis on which to form a judgment. If a contractor could show a license, however, it would be some indication of his fitness to undertake the work, though, of course, it would not give any idea of his comparative ability. It would, further, eliminate a large number of today's so-called electrical contractors, whose knowledge and experience in the electrical business have generally been gained through a brief period of dealing in electrical supplies.

The following letter has just been sent out by the Commission, as a feeler, to Ontario electrical contractors. It would almost appear to be a superfluous precaution, as reliable contractors will assuredly unanimously endorse it. We hope it will be followed by prompt legislation in the province of Ontario and the other provinces of our Dominion. Dear Sirs:—

The introduction of the Hydro-electric Power Commission's Rules and Regulations governing inside wiring has now been effected and many electrical inspectors are already appointed and such appointments will continue to be made until electrical inspection is enforced as far as practicable throughout the province. It is a well-known fact, however, not only in Canada, but all over the American continent, that one of the greatest evils which confront properly qualified electrical workers and contractors as well as manufacturers and dealers in electric supplies is the competition from unqualified, inexperienced wiremen who are, owing to the absence of laws bearing on the subject, at liberty to undertake electrical wiring or the sale of electrical apparatus or supplies utterly regardless of their efficiency or safety.

A large amount of this sort of work and the sale of such material is more or less effectually prevented where there is electrical inspection, but even in such places the inspector is continually confronted with such conditions. In many of the American cities and districts legislation is now being introduced permitting only licensed electricians to install wiring or approved material to be sold. It has been suggested from time to time that such legislation be enacted in this province, and before taking any further steps in the matter and suggesting any amendments to the present Act, it is the wish of the Commission to ascertain from people now engaged in electrical work the consensus of opinion as to the advisability of adopting measures similar to those now being introduced in other countries requiring that only licensed electricians be permitted to perform electrical work, and that only material which bears the stamp of approval be permitted to be sold or used in the province. We therefore ask for your careful consideration of this question and would appreciate your comments or suggestions.

Yours truly,  
Chief Engineer.



## THE ELECTRIC STORE

Smithville, December 1st, 1914.

Mr. John Jones,  
Smithville, Ont.

Dear Sir:—

A Merry Christmas!

In these serious times it behooves us all to plan beforehand that our Christmas giving may represent the sentiment which actuates the whole British nation to-day,—co-operation and brotherhood. The spirit of "Help one another" will be stronger this Christmastide than ever before. This will be evidenced in our gifts, which must, therefore, take into consideration, first and foremost, the circumstances of the recipients and their value to them. In former years we have sought for appropriate presents; this year they must not only be appropriate,—they must also be useful.

Electrical devices of every kind meet these requirements.

We do not claim to have a monopoly of all the Christmas presents in town that are appropriate and useful. We do claim, however, that these two qualities are particularly prominent in **all** our devices. We claim, further, that our varied list contains something that will bring a glow of pleasure to the cheeks of every boy and girl, man and woman among your list of Christmas friends. And last, it will be an ever-recurring pleasure, for the modern electric appliance is practically indestructible.

Think this over,—appropriateness, usefulness, everybody wants it, lasts almost indefinitely.

We have a carefully selected stock at prices to suit the present financial conditions,—electric irons, toasters, percolators, water heaters, vacuum cleaners, chafing dishes, flash lights, foot warmers, portable heaters, etc., in addition to sundry smaller items more in the nature of novelties and specially suitable for your younger friends. Come in and look them over. We shall be pleased to show them, to answer all your questions, to demonstrate them, and, if they please you, to set them aside for you till Christmas Eve.

Remember the watch-word this year is "useful." We have it, personified. Give us a chance to prove it,—to-day or to-morrow at latest. We are convinced,—we will convince you.

Yours very truly,

James Brown,  
Manager.



### New Arrow-E Socket

In the line with the development in large unit lighting, the Arrow Electric Company has brought out various types of Sockets and Receptacles for Mogul base lamps, the latest additions to the line being illustrated in the Catalogue Supplement recently distributed. One of these sockets is shown in the accompanying illustration. All of the various types are designed for use with "Type C" high-efficiency lamps,



Arrow-E Mogul.

attention having been paid to the particular conditions governing the use of these lamps. The new porcelain fixture sockets may be used with fixtures which have already been designed for the earlier type of brass shell Mogul socket, the over-all length being the same in both types. A special sealing compound is used which hardens with the application of heat. Northern Electric Company are Canadian agents.

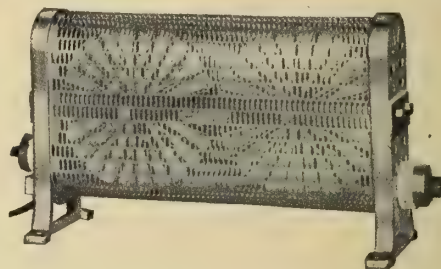
### New Line of Polyphase Induction Motors

The Robbins & Myers Company, Springfield, O., have just recently completed the development of an entirely new line of polyphase induction motors, ranging in size from  $\frac{1}{4}$  to  $7\frac{1}{2}$  horse-power inclusive. They are supplied for operation on two or three-phase, 110, 220, 440 and 550 volt circuits of all commercial frequencies. The frame of these motors consists of a cast-iron skeleton type shell which supports the stator; this exposes the stator core to the air and gives thorough ventilation. The end heads are cast separately from the frame; they are machined to fit the frame and are attached by four machine screws. Exceptionally large bearings and oil reservoirs are provided. The bearings are grooved to distribute the lubricant and are made absolutely dust-proof. The stator is built up of soft, annealed steel

laminations which are held together by bolts. The rotor is the squirrel cage type. The core is built up of steel laminations which are keyed to a cast iron spider. The rotor bars are connected to the end rings which are recessed to fit them, by double riveting and soldering. The terminals are brought out through holes in the frame which are suitably bushed with insulating material. Each motor is regularly furnished with a sliding base and cast iron pulley. They can also be supplied with idler pulley attachments or back gears if so desired.

### The Economic

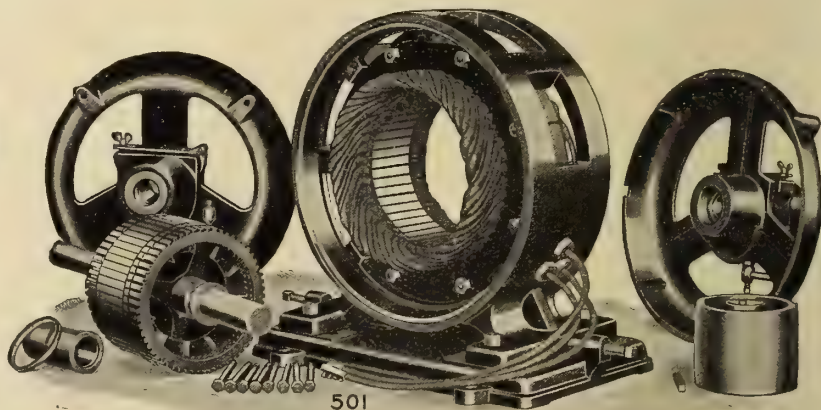
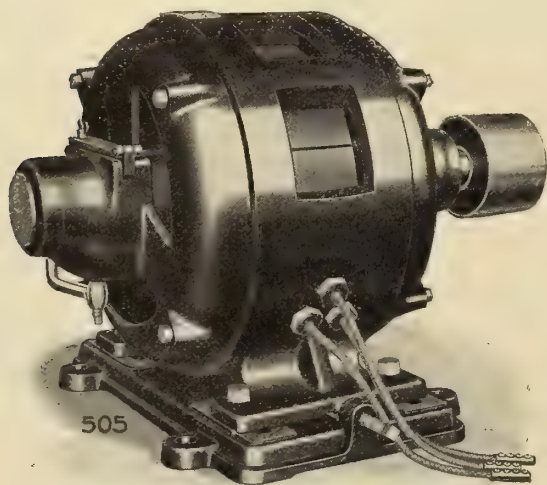
A new type of heater called the "Economic" has been put on the market by the Canadian General Electric Company. Its construction is such that with ordinary use it is claimed it will last a lifetime. It is produced in several different types. The portable single disc radiator consuming 660 watts is admirably adapted for the heating of small



rooms. In addition to this, two and three disc radiators are supplied; the two-disc consuming a maximum of 1,000 or 1,500 watts as required, and the three-disc consuming 2,100 watts. These are also supplied with heat control switches. It will be interesting to note also that this type of heater has proven itself very efficient for the heating of street cars.

### A New Electric Coffee Pot

The two-pint coffee pot is a recent addition to the line of C. G. E. coffee percolators. It is especially suited to small families where the three-pint pot may be considered too large. It has an exceptionally low operating cost as it consumes but 350 watts. This device uses either hot or cold water and will produce excellent coffee in from 10 to 15 minutes when started with hot water and in from 20 to 25 minutes when started with cold water. When starting with cold water, percolation will begin in about two minutes after the current is turned on. At least one-half pint of water should always be used in order to make the pump operative. All parts of the coffee pot are very simple in construction and may be easily and readily removed for cleaning. The



Polyphase Induction Motors, new line—Exploded view shown on right.



coffee biggin is permanently attached to the pump tube. It is made of heavy copper with nickel finish. Because of its substantial cross section of metal it is not readily dented and affords a handsome serviceable device.

#### Conduit Box Strap

The question often arises as to how certain types of receptacles can be attached to some of the modern types of outlet boxes. This appears to be applicable to the pancake type of box and to the deep box, with a cover and without lugs or ears. To meet this condition a very simple little device has been designed in two styles by Pass & Seymour, Inc., Solvay, N.Y. They call it a conduit box strap. It is made in two sizes or styles, so as to permit its use in a



Fig. 1.

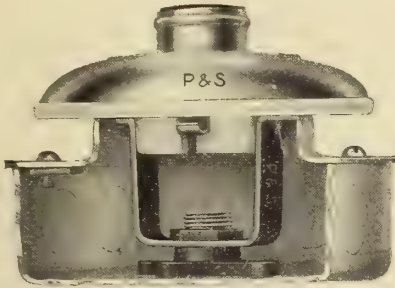


Fig. 2.



Fig. 3.



Fig. 5.

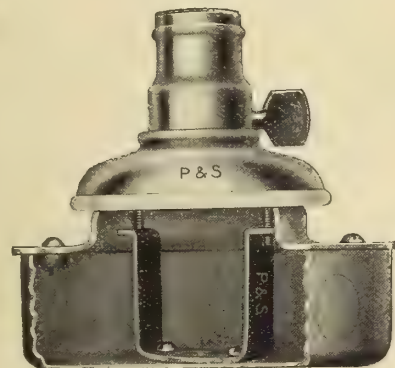


Fig. 4.

deep or shallow box. Either style may be used with or without the fixture stud. Figs. 1 and 2 show the shallow and deep boxes; in each instance the strap is attached to the fixture stud. Fig. 3 illustrates the use of the strap, not only with the fixture stud, but on a BX type of box. Figs. 4 and 5 show the use of the strap without the use of the fixture stud.

#### Novel and Effective

The Consolidated Gas, Electric Light & Power Company, of Baltimore, have hit upon a novel idea of demonstrating the use of electrical appliances. This takes the form of an electric motor car supplied with a battery of 60 cells and three 150 ft. cords. The car is brought up alongside any house, the cords run into the house and they have immediately at hand the means for demonstrating lighting fixtures, heating fixtures, heating devices, vacuum cleaners or other household appliances. One of the big advantages of this equipment is that it is applicable to the unwired house, and is often a sufficient argument in favor of having the house wired up. On account of the unique idea, too, which is further emphasized by large signs placed on the car, the whole neighborhood is apprised of the nature of the demonstration. This usually results in a number of demonstrations being

given on the same street. It is claimed that this has been a most effective means of assisting the wiring and appliance department of this company.

Escher Wyss & Company, have been awarded the contract for a 12,000 kw., Turbo-Generator set for the Corporation of Leeds, England. This contract had previously been awarded to a German firm but was, after declaration of war, awarded to Escher Wyss & Company, with Siemens Generator 3-phase, 50-cycles, 6,750 volts. The speed of the set is 1,500 r.p.m.

#### Trade Publications

**Worm-gear Chain-blocks**—Bulletin issued by the Herbert Morris Crane & Hoist Company, Toronto, describing and illustrating the Morris worm-gear chain-blocks.

**Transformers & Meters**—Leaflets issued by the Ferranti Electric Company, Limited, Toronto. Leaflet T8 illustrates and describe pole-type transformers; leaflet T9 illustrates power transformers and leaflet T10 describes in considerable detail, with illustrations, Ferranti single phase pre-payment meters.

**Electrical Catalogue**—Small booklet by the MacGovern Company, 114 Liberty Street, New York City, dealing with contractors' materials, air compressors, hoists, steam shovels, car equipment, etc., carried in stock by this company.

**Water Softening**—Leaflet number 17, issued by the Canadian Allis-Chalmers Company, Limited, Toronto, describing the Sorge-Cochrane hot process system of water softening, with illustrations.

**Textile Machinery**—Bulletin number 48015, issued by the Canadian General Electric Company, Limited, describing and illustrating a transformer specially designed for operating electric stop-motion of textile machinery.

## "SOLEX" TUNGSTEN LAMPS



Solex Lamps are of the best quality and the prices are Right. We are getting regular deliveries of "Solex" Ductile wire drawn tungsten filament lamps in all sizes and voltages.

Write us stating your requirements, and we will mail samples and prices.

We have a good agency proposition. Are You interested?

Agents for Evershed & Vignoles', Meggers, Recording and Indicating Volt and Am meters. Chamberlain & Hookham's Watt Hour Meters, Prepayment Meters, Time Switches and Limiters.

### Spencer & Aspinall, Limited

Head Office: 617 New Birks Bldg., Montreal

Branch Office: 144 Slater St., Ottawa



# Current News and Notes

## Bolton, Ont.

The hydro line is being extended from Woodbridge north to Bolton, and it is expected this village will be lighted by Niagara power in time for Christmas.

## Brantford, Ont.

The Township Council will proceed in the near future to supply Grandview, Parkdale and Echo Place with hydro power and light.

## Brampton, Ont.

The Chinguacousy Township Council have authorized the town of Brampton to look after the installation and operation of their electric light and power business.

## Grand Forks, B.C.

This district is shipping another 10,000 lot of poles to the Hydro-electric Power Commission of Ontario.

## London, Ont.

The method of charging by the local Hydro Commission in London has been different from other cities in the hydro area, in that London consumers have been given the option between the standard system adopted by the Commission and a straight meter rate. It is understood that after December 1st the straight meter rate will be discarded and London will fall in line with the other municipalities.

## Lambeth, Ont.

A by-law was submitted on November 28th asking the authority of the ratepayers to make an agreement with the Hydro-electric Power Commission of Ontario for the supply of power.

## Mount Brydges, Ont.

A hydro transmission line has been completed to this point, and it is expected that power and light service will be commenced about December 1st.

## Mount Forest, Ont.

A by-law will be submitted on January 1st, authorizing the Town Council to make terms with the Hydro-electric Power Commission of Ontario for a supply of power.

## Montreal, Que.

The Grand Trunk Pacific telegraphs between Winnipeg and Prince Rupert, a distance of 1,279 miles, were linked up and communication opened on November 18. This will give a telegraph service to numerous places which have hitherto been without this facility.

The Westmount Council have completed a further section of the improved lighting system designed by Mr. G. W. Thompson. Fifty-nine standard lamps have been put into service on Sherbrooke Street and Wood Avenue, and later other thoroughfares will be dealt with.

## Port Arthur, Ont.

The Report of the Commissioner of Utilities of the city of Port Arthur for the quarter ending September 30th, 1914, showed a gross revenue of \$39,894.27; operating expenses \$22,027.07; fixed charges \$10,240.84. This leaves a net profit of \$7,626.36. The total net gain for the first nine months of the year is \$40,929.58. According to a recent statement published by the Hydro-electric Power Commission, Port Arthur would appear to have made the best showing of any of the municipalities connected with the Hydro-electric Power Commission.

## Regina, Sask.

The operation returns of the Municipal Street Railway System of Regina for the week ending November 7th were as follows: revenue \$3,051.75; passengers carried 70,485. Corresponding figures for week ending November 14 were \$2,999.30 and 72,963.

## Toronto, Ont.

The York Township Council has authorized the Toronto Hydro-electric Commission to install street lights in Swansea and Runnymede at an average yearly maintenance cost of about \$20 per light. The contract is for ten years, but expires if and when this district is annexed to the city.

## Vancouver, B.C.

The Farmers' Telephone Company, Limited, is in liquidation.

The Vanderhoof Power Company, Victoria, B.C., have made application for a license to take 100 second feet of water from Stoney Creek and store it for power purposes.

## Williamsburg, Ont.

A by-law was carried on November 17th authorizing the expenditure of \$2,750 on an electrical distributing system to be connected up with the Hydro-electric Power Commission of Ontario's general distribution plant.

The Dawson, Yukon, authorities are said to be planning to establish a municipal electric light and telephone plant, estimated to cost \$165,000.

Mr. Colin Kemp, B.Sc., and Mr. L. S. Eaton, B.Sc., have been appointed Sessional Lecturers in Electrical Engineering, at McGill University, with Messrs. H. A. Chambers and G. L. Stewart demonstrators for the present session.

Mr. F. Holmes, works manager of the Hart Accumulator Company, Limited, London, Eng., is on a visit to Canada, in connection with the plant which has been erected at St. Johns, P.Q., by the Canadian Hart Accumulator Company, of which Mr. C. W. Knighton is manager.

Escher Wyss & Company, of Montreal, have been awarded the contract for two 2,250 h.p. water wheels with accessories by The Hydro-Electric Power Commission of Ontario for their new hydro-electric power plant at Eugenia Falls. These wheels work under a head of 540 feet running at 900 r.p.m.

# Tenders

A few dollars spent in advertising your proposals in the

## Contract Record and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.



# UNDERGROUND CABLES

## LOW AND HIGH TENSION

FOR LIGHTING,  
POWER,  
STREET-  
RAILWAYS,  
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ARMOURED  
CABLES FOR  
STREET  
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CABLES OF ALL  
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RUBBER INSULA-  
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Also Bare and Weatherproof Wires and Cables,  
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### Galvanized Iron Wire and Strand

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## MONTREAL, CANADA

BRANCHES :

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Winnipeg,

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Vancouver.



# Condensed Department

## Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

## Situations Wanted

Meter and instrument man desires position with power company; experienced in repair and test work on switchboard instruments and service meters or as switchboard operator. Apply Box No. 90, Electrical News, Toronto. 23-24

Position wanted as chief electrician for manufacturing plant or electrical superintendent for small town. Twelve years' experience in general installation, operation and repair work, on high and low voltage A.C. and D.C. Seven and a half years in present position. Details of experience, etc., on request. Box No. 107, Electrical News, Toronto. 23

## Sales Engineers Wanted

A large firm specializing in the manufacture of motors of all classes desires to secure sales engineers in various parts of Canada. Firms who can carry a stock of motors are preferred. Write stating the territory that you can cover. Box 96, Electrical News, Toronto. 21-24

## Agents Wanted

Large firm making low voltage transformers and electrical measuring instruments wants sales agents for Canada. These transformers are for sign lighting, bell ringing, and toy requirements. The electrical measuring instruments include a complete line of switchboard and portable Ammeters and Voltmeters. All agents to work on a commission basis. Write stating what territory you can handle. Box 93, Electrical News, Toronto. 21-23

## SECOND HAND ELECTRICAL MACHINERY

Bought, sold, rented, and exchanged. We have the largest stock in America. Send for our monthly bargain sheet showing complete stock with our prices.



Established 1893

## Agents Wanted

Large firm making a complete line of electric centrifugal pumps; automatic electric compression water systems; electrically driven multi-stage turbine pumps; electrically driven double acting pumps and a number of other lines, want sales agents for various parts of Canada. Write stating what territory you can handle. Apply Box 94, Electrical News, Toronto. 21-23



## Electrical Machinery

Motors, Dynamos, Generators,  
Electrical Pumps and Supplies.  
Electrical Contractors.  
Motor Repairs.



52 Queen Street - OTTAWA



# XCELADUCT means

*Satisfaction for the Engineer  
Satisfaction for the Electrician  
Satisfaction for the Customer*

THE  
CONDUIT  
OF NO  
REGRETS

## XCELADUCT

Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by COPPER-PLATING and zinc coating.

Clean threads and smooth enamelled interior allows rapid fishing.

## ORPENITE

Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

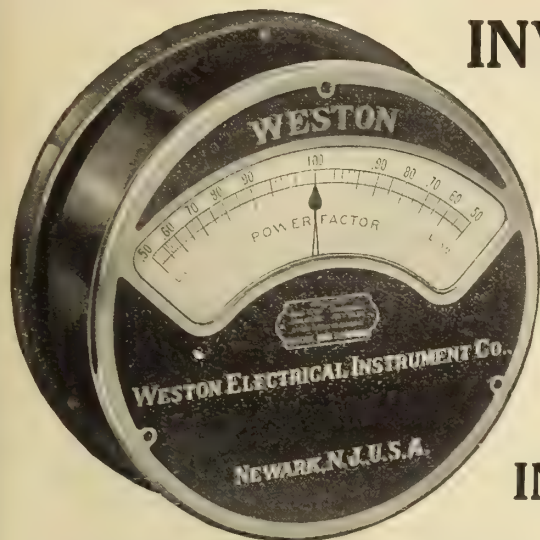
# Orpen Conduit Company, Limited

TORONTO

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We invite full inquiry into the merits of **Weston Power Factor Meters** and **Frequency Meters** and also **Wattmeters**, **Synchrosopes**, **Ammeters** and **Voltmeters** for Switchboard service on alternating current circuits. Send for catalogs and advise us the kind of instruments in which you are interested, whether for alternating or direct current service.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

### WESTON ELECTRICAL INSTRUMENT COMPANY, Main Office and Works, NEWARK, N. J.

Mr. Stanley Brown, 114 Liberty St., New York City.  
Badt-Westburg Elec. Co., 832 Monadnock Block, Chicago, Ill.  
Mr. F. E. Gilbert, 303-4 Hale Bldg., 1326 Chestnut St., Philadelphia, Pa.  
Mr. Geo. H. Moseman, 176 Federal St., Boston, Mass.

Mr. Milton Mill, 915 Olive St., St. Louis, Mo.  
B. K. Sweeney Electrical Co., 2910 Huron St., Denver, Colo.  
Mr. Frank E. Smith, 682 Mission St., San Francisco, Cal.  
Mr. S. C. Dinsmore, 1933 Dime Bank Bldg., Detroit, Mich.  
Walter P. Ambos Company, 1729

East 12th St., Cleveland, Ohio.  
A. H. Winter Joyner, Ltd., No. 76 Bay St., Toronto, Canada.  
Weston Instrument Co., Ltd., Geneststrasse 5, Schoneberg, Berlin, Germany.  
Mr. D. R. Petest, 415 Fourth Natl. Bank Bldg., Atlanta, Ga.  
Mr. Edwin Wortham, Suite 28

Allison Building, 8th St. and Main St., Richmond, Va.  
Montreal }  
Winnipeg } *Northern Electric Company*  
Vancouver }  
Calgary }  
Weston Electrical Instrument Co., Audrey House, Ely Place, Holborn, London, E.C.



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**British Insulated & Helsby Cables, Limited**

PAID-UP CAPITAL, \$8,500,000.00

HEAD OFFICE—PRESCOT, ENG. Works at PRESCOT, HELSBY and LIVERPOOL

Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and double steel tape armored cable for a working pressure of 660 volts. This cable is for laying direct in the ground without any protection whatever and is similar to that supplied to the cities of Saskatoon, Prince Albert, etc., etc.

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SOLE CANADIAN REPRESENTATIVES:

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MONTREAL, QUE. LIMITED



# X ARMS

Do You Appreciate what

*Superior*

means when applied to X Arms, Locust Pins, or Pole Line Hardware?

It means in Locust Pins, Braces, Bolts, Washers, Pole Steps, Etc., all meet A.T. & T. specifications, and in Arms: Washington Fir—at least 85 per cent. heart.

Spruce—Kyanized,

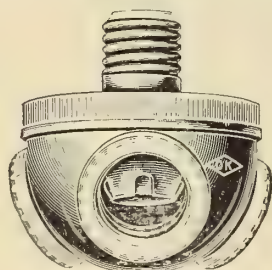
Georgia Pine—Long Leaf—at least 75 per cent. heart.

All guaranteed. We stock nothing regularly of a quality inferior to the above.

## STUART - HOWLAND CO.

131 to 141 Federal St.,

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No. A 498 (3 Light).



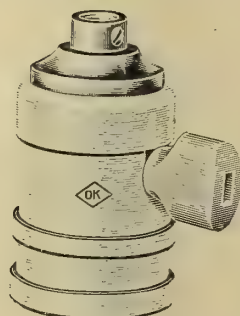
A 566



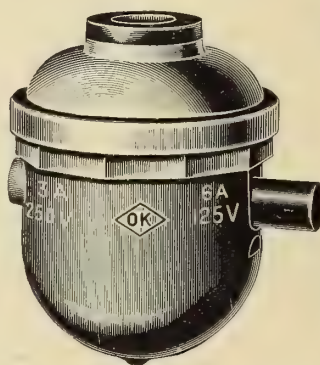
## SUPPLIES

(National Electric Code Standard)

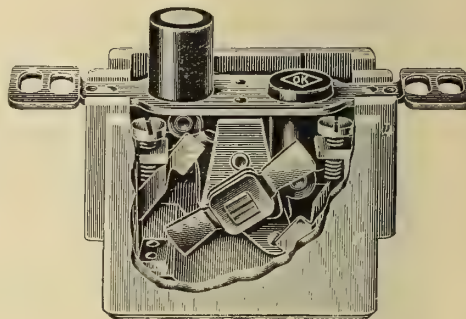
That's All



No. A 697



No. A 405



No. A 231

Order through your jobber

### Sterling Telephone & Electric Co., Ltd. London, England

Write for New Catalogue

## We Have a Bell For Every Purpose



There can be only one best and that is the Schwarze. No. 12 Common Magneto Extension for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire is all active. Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and very much louder, and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof.

Write for catalogue.

All resistances.

### Schwarze Electric Co., Adrian, Michigan

Norton Telephone Co., Canadian Agents

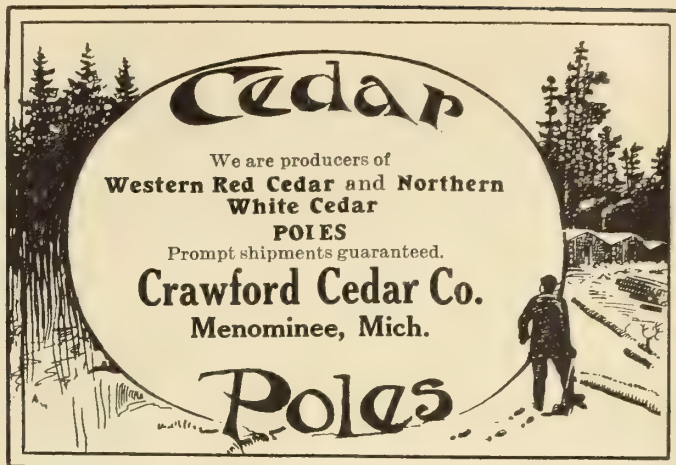


**British Columbia Cedar Poles****Open Tank Treated With  
AVENARIUS CARBOLINEUM**

will double or treble the ordinary life of your line at a small cost. It will pay you to investigate. Ask for full information and our special folder.

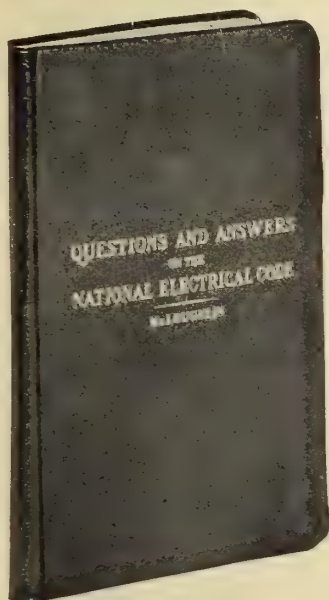
**The Lindsley Brothers Company**

"Good Poles Quick"  
Spokane - Washington



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### Questions and Answers on the National Electrical Code



It tells at once the answer to the questions on code requirements. Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money. Every question is carefully indexed so that you can locate the fact you are after instantly.

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The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding \$1.00 net, prepaid.

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Electrical News,

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**TRUMP HYDRAULIC TURBINES**

Backed by over 40 years' experience  
in the design and manufacture of  
water power equipment

TRUMP Turbines are built in all sizes, types and capacities

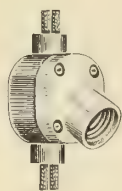
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**THE TRUMP MFG CO.,** Greenmount Ave.  
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# "Unilets"

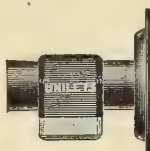
"A fitting for every fit. The most adaptable and flexible units on the market."



"UNILETS," being drawn from steel, are very much lighter than cast-iron fittings for the same size conduit, yet possess greater mechanical strength, and due to their thin-wall construction allow at least 50 per cent. more wiring space than other fittings of similar type.

"Unilets," because of their lightness in weight, are easier for the workman to handle and save considerable in transportation charges and are far more durable and not subject to breakage as are the brittle, cast-iron fittings.

"Unilets" possess many points of superiority over and above other fittings now on the market and to know their true value is to try them on your next job. The conduit is steel, why not the fitting?



"Unilets" are fully described in our new and complete catalogue No. 7, also small booklet, both of which will be sent upon request. Do not delay, write us today, addressing Dept. "D".

## Appleton Electric Company

Main Office  
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Chicago

212-214  
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For Sale in Canada by

The Mainer Electric Co., Ltd., Winnipeg

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# Use the Railway's Trolley Poles

as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of

## ERECO Combination Railway Lighting Pole Fixtures



This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

Design No. 10015.

## Electric Railway Equipment Co. Cincinnati, Ohio

Designers

Canadian Representatives:

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N. Y. Office, 30 Church St., Hudson Terminal Bldg.

Manufacturers



"Look for the Gray Shell"



Sectional view, Economy Knife Blade renewable cartridge Fuse.

# ECONOMY Renewable Cartridge FUSES

made in Canada and sanctioned by the Canadian Fire Underwriters' Association.

*New, improved types of ferrule and knife blade fuses are now offered in all capacities and commercial voltages*

The Economy "Drop Out" Renewal Link is the greatest improvement in enclosed fuse manufacture since fuses were first put on the market. It is now used in all sizes of Economy fuses, both knife blade and ferrule types, except in the ferrule type under 15 amperes. Its uses makes filling material of any description unnecessary. Renewals are made easily and quickly. The protection afforded by Economy renewable cartridge Fuses is absolute—and a saving of at least 80 per cent. per year in fuse maintenance is being effected wherever they are in use. Two renewal links are furnished free with every Economy Fuse.

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Manufacturers in Canada of "S & C" Extra High Potential Fuses—to 150,000 volts.

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Meet and overcome the many difficulties in holding flexible tubing securely in switch boxes, cabinets, outlet boxes and junction boxes.

They are one-piece bushings, easily and quickly installed without the use of tools, and can be removed for inspection and replaced without injuring bushing or tubing. THEY SAVE TIME AND TROUBLE.

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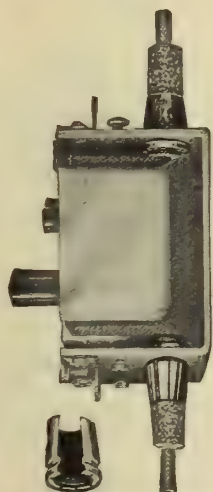
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We also manufacture FLEXIBLE TUBING CLAMPS for holding tubing at wall and ceiling outlets where boxes are not used. TRY THEM.

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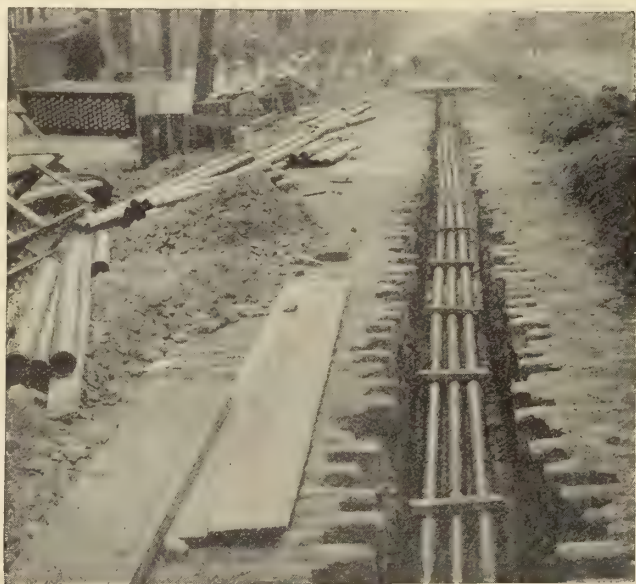
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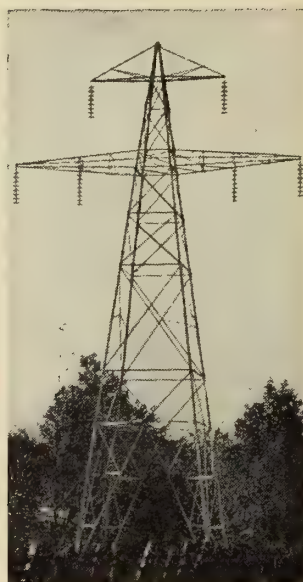
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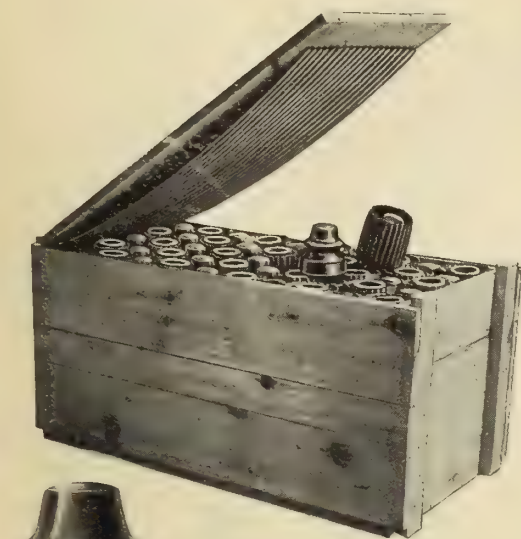
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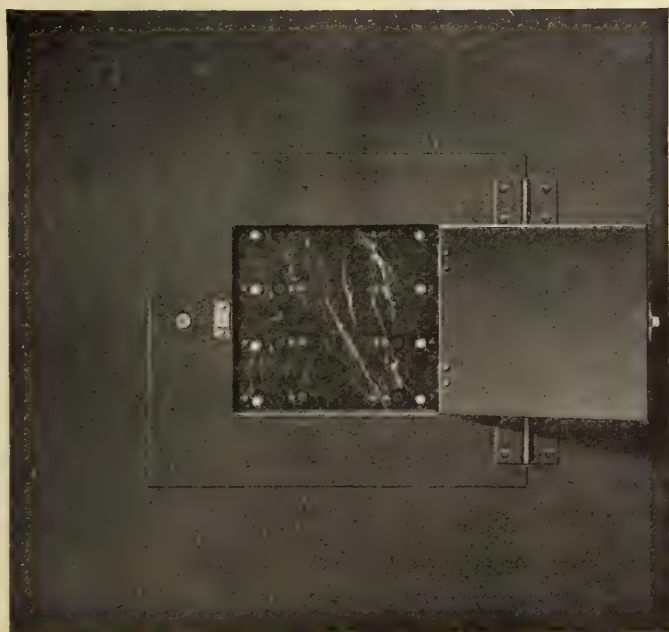
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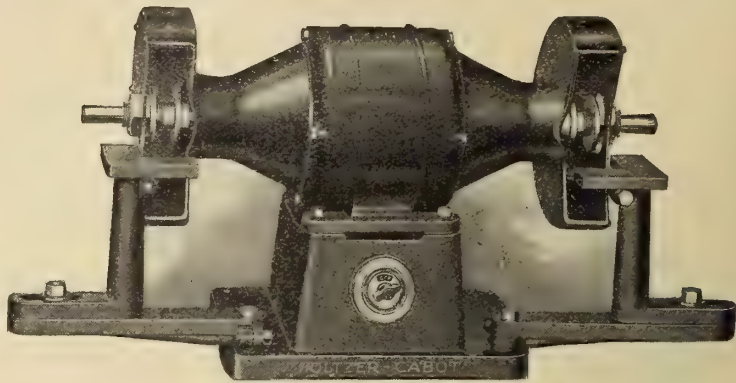
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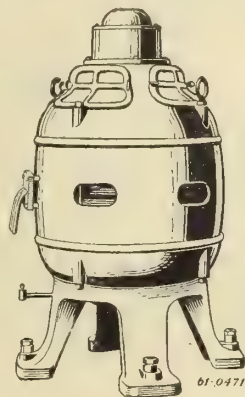
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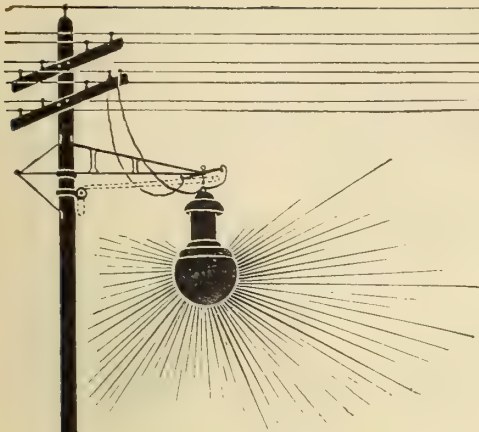
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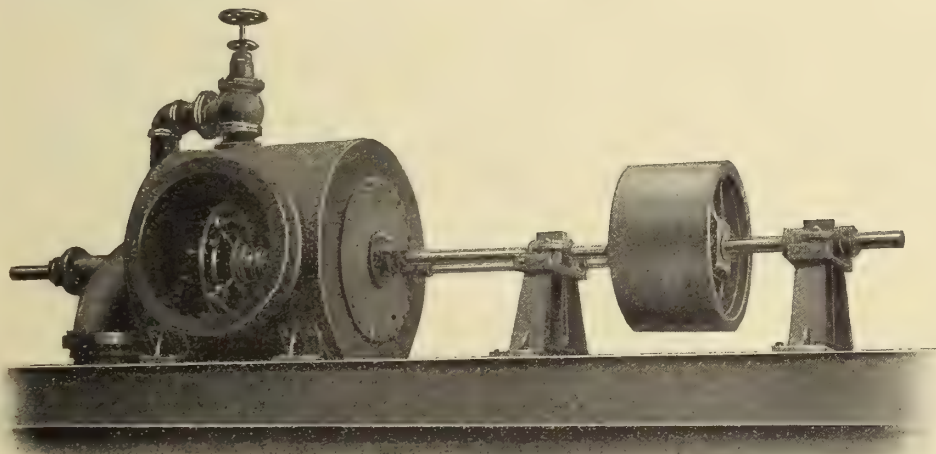
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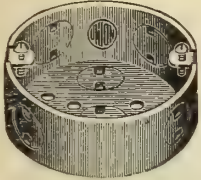
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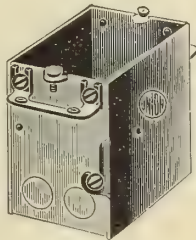


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The "UNION" Sectional Switch Box is acknowledged to be the leader. Various depths and forms to meet every need.

"UNION" Boxes are for sale by all leading jobbers. Complete information in Box Catalog No. 27.



"DC" Box



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We make a specialty of Pins for High Voltage Transmission.

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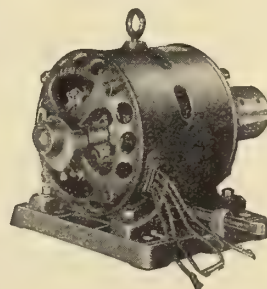
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**Single Phase Motors**



Among them are :

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1/6 to 40 H.P.—25 to 140 cycles.

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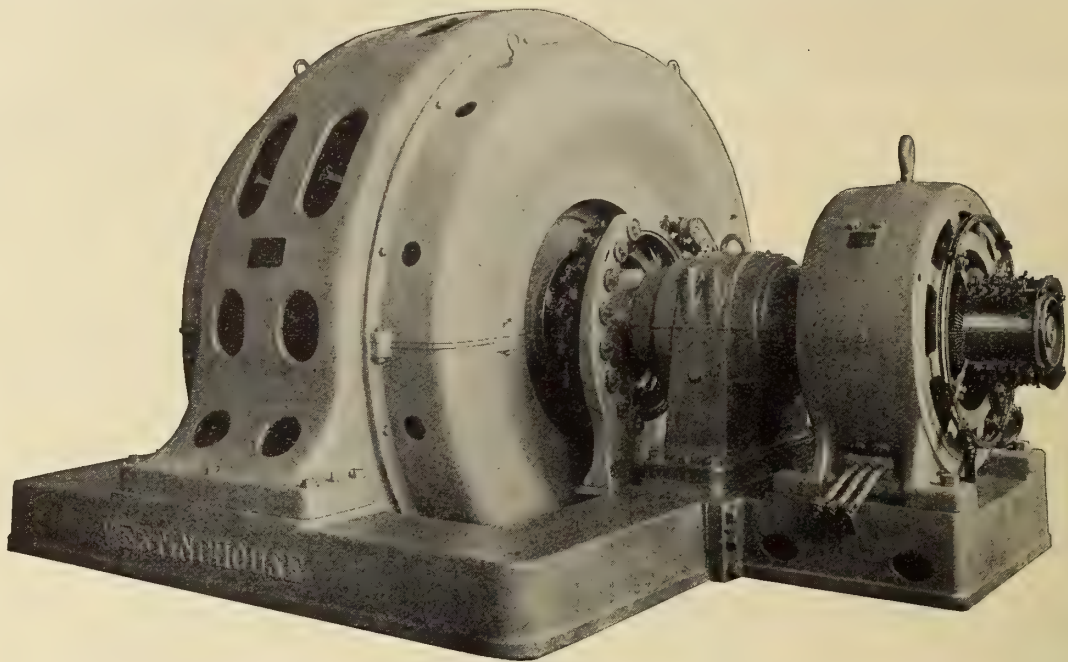
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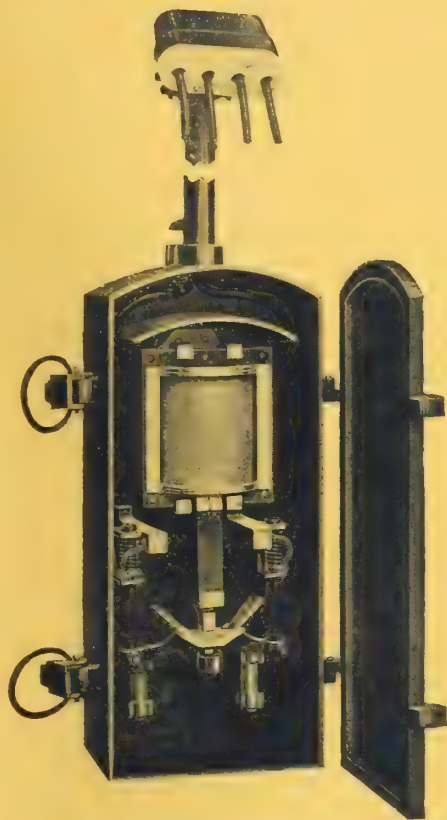
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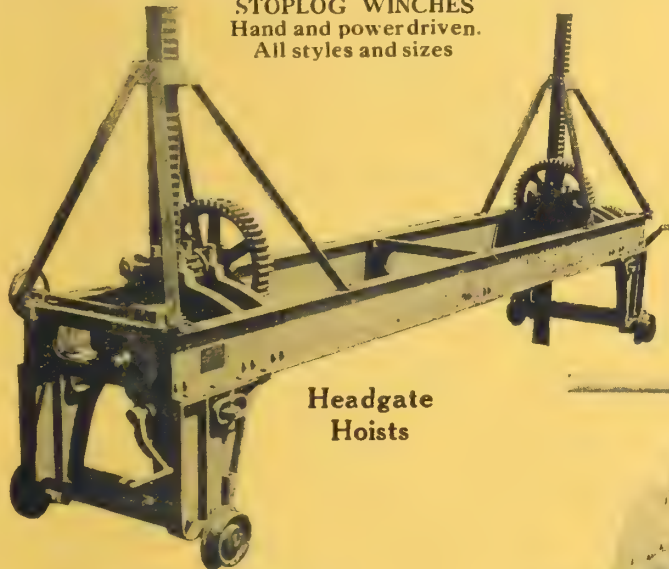
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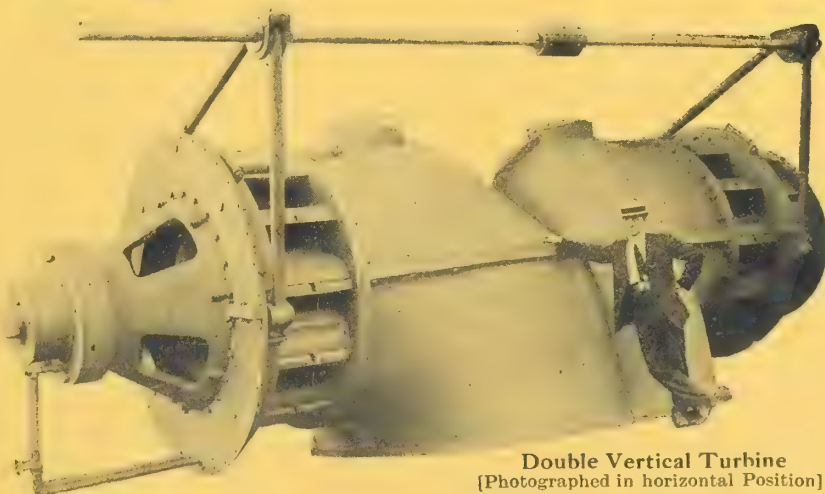
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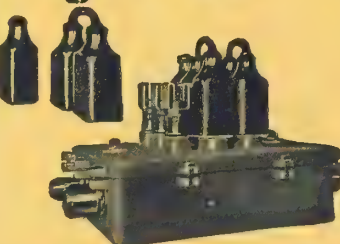
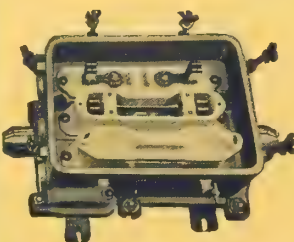
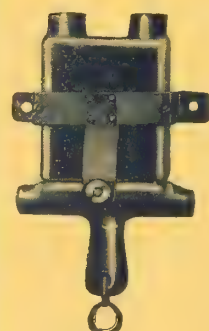
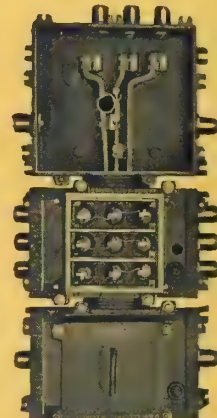
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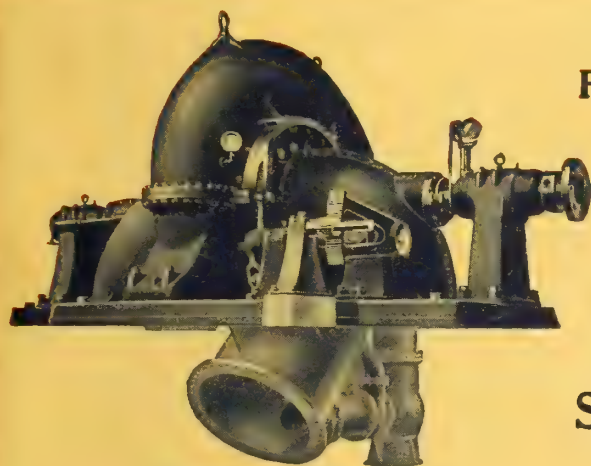
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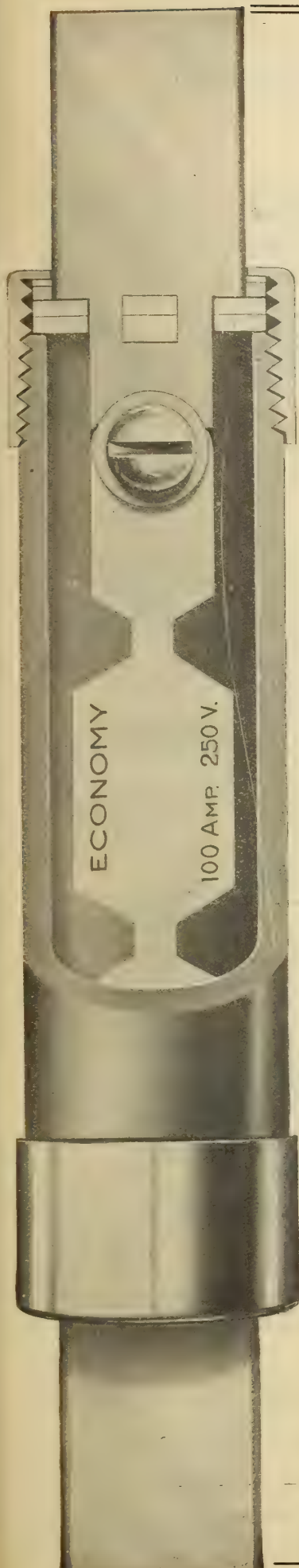
The entire volume of the fibre shell is unoccupied except by the Economy “Drop-Out” Renewal Link. The liberal air space thus provided permits a rapid gas expansion, but with low resultant pressure due to the small amount of metal in the “Drop-Out” Link which is volatilized by operation. No end-holes allow direct venting of fire, as the gases liberated are restrained by the resilient and metal end-washers which entirely close that portion of the fuse, permitting the gases to escape only by the path provided by the clearance of the threads under the brass cap. In addition, the centering washer system aligns and centers the blade members and allows flexibility sufficient for the adjustment of the blades to the clips into which the fuse is inserted and therefore to give good, uniform contacts on both sides of the blades.

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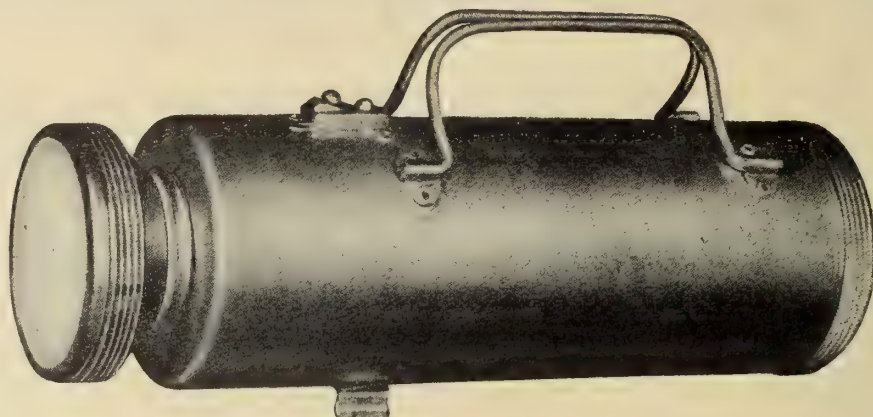




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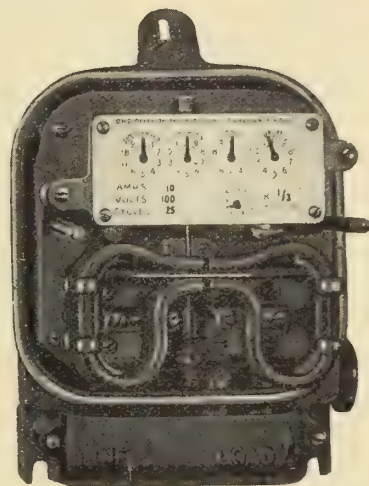
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- Diesel Engines for Land and Marine Work, by A. P. Chalkley. Published in 1913 by D. Van Nostrand Company. 276 pages, illustrated. Price \$3.00.
- A Handbook on the Steam Engine, by Herman Haeder. Published in 1914 by Crosby, Lockwood & Son. 522 pages, illustrated. Price \$3.00.
- Electrical Engineers' Pocket-book, by Horatio A. Foster. Published in 1913 by D. Van Nostrand Company. 1599 pages, illustrated. Price \$5.00.
- Pumps and Pumping, by M. Powis Bale. Published in 1912 by Crosby, Lockwood & Son. 120 pages. Price \$1.50.
- Alternating Current Machinery, by Esty. Published in 1912 by the American School of Correspondence. 468 pages, illustrated. Price \$3.00.
- A Laboratory Manual of Alternating Currents, by John H. Morecroft, E.C. Published in 1912 by Renouf Publishing Company. 248 pages, illustrated. Price \$2.00.
- American Electricians' Handbook, by Terrell Croft. Published in 1913 by McGraw-Hill Book Company. 750 pages, illustrated. Price \$3.00.
- Applied Electrochemistry and Welding, by Charles F. Burgess, E. E., and George W. Cravens. Published in 1914 by American Technical Society. 140 pages, illustrated. Price \$1.50.
- Baudot Printing Telegraph System, by H. W. Pendry. Published in 1913 by Whittaker & Company. 144 pages, illustrated. Price \$1.00.
- Conversations in Electricity, by Branch. Published in 1908 by the Branch Publishing Company. Price \$2.00.
- Direct and Alternating Current Testing, by Bedell. Published in 1909 by D. Van Nostrand & Company. 264 pages, illustrated. Price \$2.00.
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- Electric Arcs, by Clement D. Child, Ph.D. Published in 1913 by D. Van Nostrand Company. 194 pages, illustrated. Price \$2.00.
- Electric Arc Phenomena, by Ewald Rasch. Published in 1913 by D. Van Nostrand Company. 194 pages, illustrated. Price \$1.00.
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- Electric Wiring and Lighting, by Charles E. Knox, E. E. Published in 1913 by the American School of Correspondence. 176 pages, illustrated. Price \$1.50.
- Electrical Engineering, by Steinmetz. Published in 1909 by McGraw-Hill Book Company. 454 pages, illustrated. Price \$3.00.
- Electrical Measurements, by O. J. Bushnell and A. G. Turnbull. Published in 1914 by American Technical Society. 164 pages, illustrated. Price \$1.00.
- Electricians' Operating and Testing Manual, by Henry C. Horstmann and Victor H. Tousley. Published in 1910 by Frederick J. Drake & Company. 352 pages, illustrated. Price \$1.50.
- Electricity, by H. M. Hobart, B.Sc. Published in 1909 by Constable & Company. 206 pages, illustrated. Price \$1.50.
- Electricity—Experimentally and Practically Applied, by Ashe. Published in 1910 by D. Van Nostrand & Company. 350 pages, illustrated. Price \$1.00.
- Electricity for Everybody, by R. Borlase Matthews. Published in 1912 by Electrical Press Limited. 316 pages, illustrated. Price \$1.00.
- Electro-Dynamics, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company. 298 pages. Price 50c.
- Elementary Graphic Statics, by John T. Wight. Published in 1913 by Whittaker & Company. 226 pages, illustrated. Price 75c.
- Elementary Magnetism and Electricity, by Cyril M. Jansky, B.S. Published in 1914 by McGraw-Hill Book Company. 212 pages, illustrated. Price \$1.50.
- Elementary Telegraphy, by Pendry. Published in 1910 by Whittaker & Company. Price \$1.00.
- Elevators, Hydraulic and Electric, by Calvin F. Swingle. Published in 1910 by Frederick J. Drake & Company. 100 pages, illustrated. Price \$1.00.
- Handbook of Electrical Methods, Compiled from Electrical World. Published in 1913 by McGraw-Hill Book Company. 284 pages, illustrated. Price \$2.00.
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- Insulation and Design of Electrical Windings, by A. P. M. Fleming and R. Johnson. Published in 1913 by Longmans, Green & Company. 224 pages, illustrated. Price \$2.
- Molded Electrical Insulation, by Emile Hemming. Published in 1914 by Ward Clausen Company. 260 pages, illustrated. Price \$1.00.
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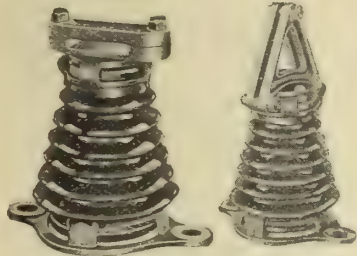
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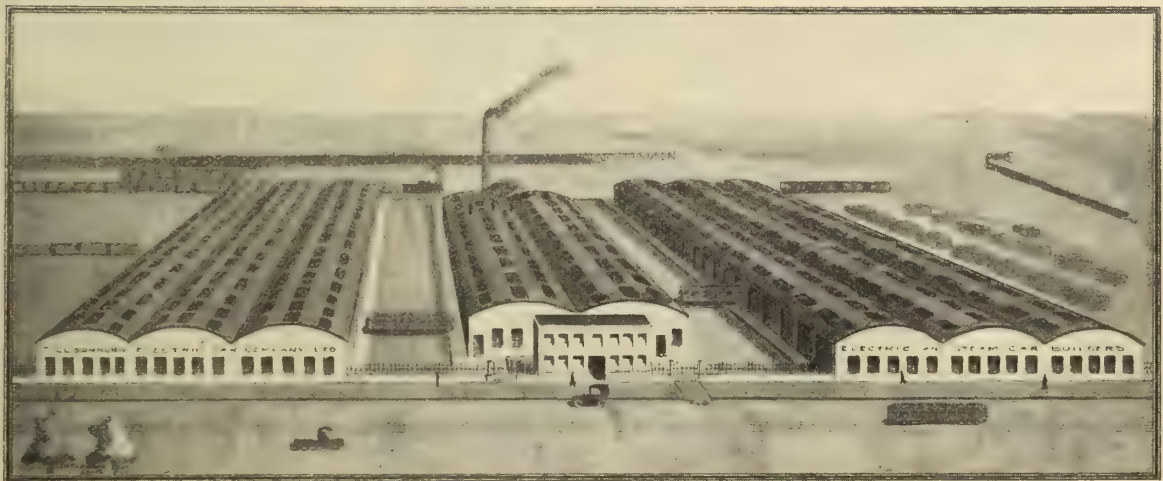
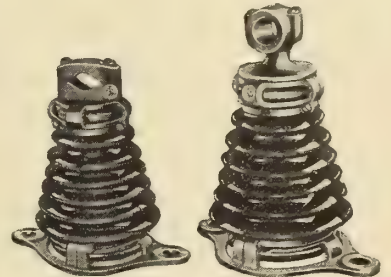
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Our tape Contract should prove of interest to all live Electrical Dealers. Write our nearest House.

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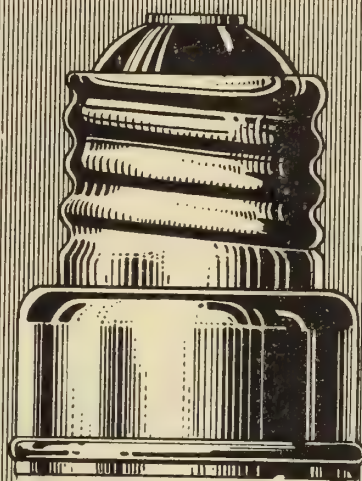
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that are made right—

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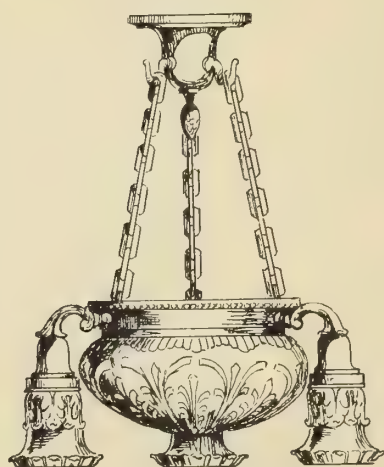
Write us — Let us quote you.

Advice Free by Skilled Engineers

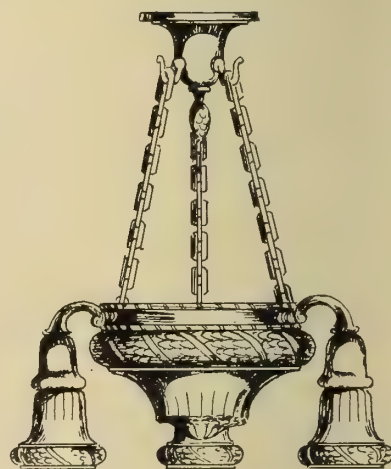
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Specials of  
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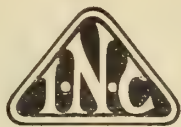


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**Wire, Rods and Sheets**

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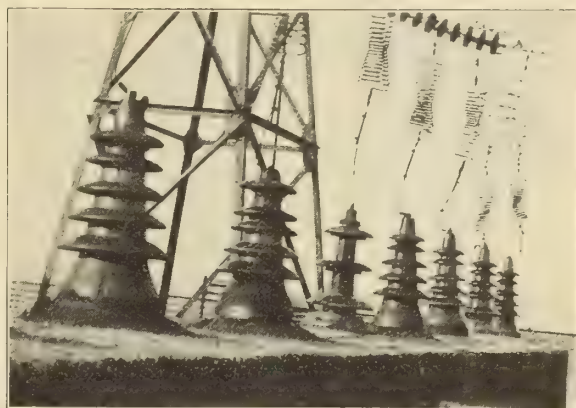
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Complete line of Hubbell goods on hand in Canada for quick delivery

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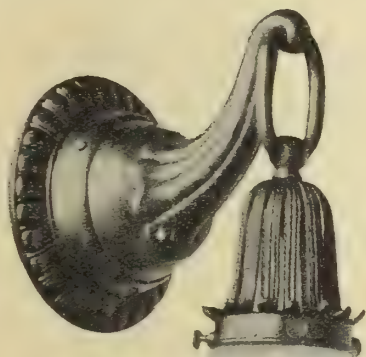
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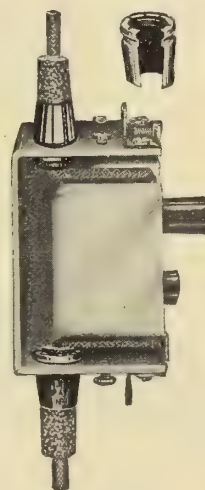
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combine function of porcelain bushing and tape, and gives the job a finished, mechanical appearance. TRY THEM AND BE CONVINCED.

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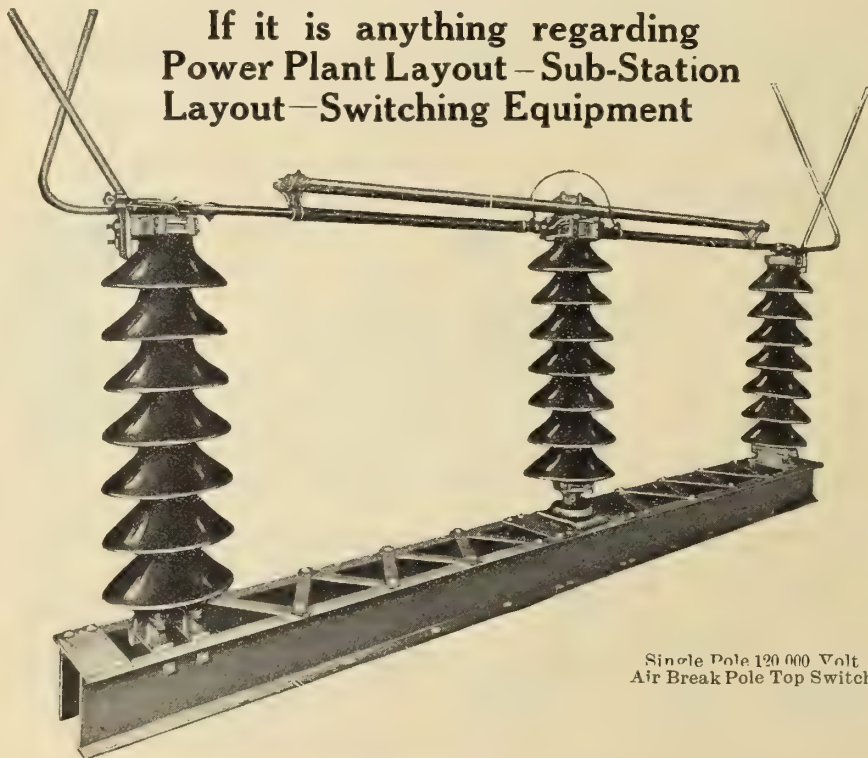
East of Winnipeg - \$39.50

Complete set of attachments \$10.00 extra

*Write us for dealers' proposition.*

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Berlin, Ont.

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Air Break Pole Top Switch

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We will give you the most  
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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for \$2.00 per annum. United States and foreign, \$2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

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Vol. 23 Toronto, December 15, 1914 No. 24

## The Electrical Contractor and the Central Station

Little by little the electrical dealer and the electrical contractor are winning recognition as necessary units in the proper development of the electrical industry. Slowly, but surely, the central station is withdrawing to its own legitimate field, the manufacture and sale of electric current. The handling of electrical appliances and supplies is evidently and logically a business in itself quite as much as is the installation of wiring and conduit.

The formerly unanswerable argument of the central stations that they are driven in self-defence to wire houses and sell devices because otherwise this part of the industry would be neglected and the demand for their electric current supply would be thereby curtailed, is now being answered by the electrical dealers and contractors themselves, who are developing business methods, showing signs of capital resources, and giving other indications of being in a position to carry on this work, if the central stations will drop out.

Two important considerations have to be considered in connection with the situation during the past. The first has been the unsatisfactory status of a very large number of so-called dealers and contractors. These could not be depended on to build up the business as the central station felt it should and could be built up. The second consideration is the natural outgrowth of this. The central station's demand is regulated to a very large extent by the activity of the dealers and the contractors in his constituency. If these fail to do their part, the number of installations and sales of appliances will be smaller than, under vigorous campaigning, they ought to be, and the central station is the direct loser.

The recent action of the Hydro-electric Power Commission of Ontario in sending out letters to the various contractors to learn their opinions on the advisability of licensing all electrical contractors, is a step in the right direction: What we want is a more responsible class both of dealer and contractor. There is little doubt that, as soon as the central station recognizes the ability of the dealer and contractor to develop his constituency by encouraging the use and prosecuting the sale of every kind of electric current consuming device, then the central station will willingly hand over this part of the business to the dealer and contractor and confine himself to his proper sphere—generation and delivery.

For the best results, the closest co-operation will be necessary between these three classes. In the United States a very active move has been made towards co-operation and the electrical contractors have a very strong national association. In Canada nothing of the sort exists, except at local points, and the evident need is a number of provincial associations which shall possibly eventually be merged into a Dominion association. Up to the present time, with the chaotic condition of electrical contracting all over the Dominion, an association appears to have been an impossibility, but with improved conditions, with electrical contractors realizing more fully the importance of their work and with the general recognition on the part of the public that electrical contracting is a profession, the possibilities of a strong association appear to be greatly improved.

Mr. Geo. E. Shepherd, an electrical engineer of recognized ability, who has thrown in his lot with the electrical contractors, writes an interesting article in a recent issue of the National Electrical Contractor on the relationship between the dealer, contractor and central station, expressing, of course, the contractor's point of view. We believe Mr. Shepherd is inclined to credit the central station with an undue desire to encroach upon the legitimate field of the contractor, which is not borne out by the facts. As stated above, we are satisfied that, as soon as the electrical contractor demonstrates his ability to take up this work himself, the central station will be only too pleased to lay it down. Some abstracts from this interesting paper appear in other pages of this issue.

## International Engineering Congress

The American Institute of Electrical Engineers have made a further announcement relating to the International Engineering Congress, which will be held in San Francisco, California, in connection with the Panama-Pacific International Exposition, on September 20-25, 1915. Since the outbreak of the European War, considerable pressure has been brought to bear by German sympathizers to have this congress postponed, but without success.

The papers to be presented before the Congress will cover the general field of engineering as indicated in the list of volumes given under the heading "Transactions." These papers will treat the topics comprehensively and with special reference to important lines of progress during the past decade, and will cover approved present practice and lines of future development. It is intended that each paper shall be accompanied by a bibliography of the subject.

Since the development of the situation in Europe, it has been necessary to consider the possible modification of the original plans of the Congress. Originally, about 290 papers were contemplated, and the Committee of Management now state that of these about 220 are either definitely promised or are well assured. Among these are contributions from England, Spain, Sweden, Holland, Canada, India, Italy, China, Japan, Australia, and various South American countries. The remainder, apportioned among the nations in the present European war zone, are uncertain, and it must be expected that some of them will not be secured. It is believed, however,



that certain other papers may be substituted for these, and that the Congress work will be carried out with a minimum of change. Timely notice will be given regarding any changes in detail.

Special efforts will be made to secure discussions, carefully prepared in advance for presentation with the papers, and opportunity for oral discussion will be afforded at the various sessions of the Congress. Discussions may be submitted in any language, at the choice of the writer, and, if in other than English, will be translated for publication.

It is the intention to publish the Transactions in ten 6 by 9-in. volumes of about 500 pages each, with one smaller volume which will contain the reports of the business meetings of the Congress, together with a title and author index and a brief digest of each paper. The following is a schedule of the volumes:

Index and Digest.—General proceedings, indexes, and digests.

Volume I.—The Panama Canal (24 topics).

Volume II.—Waterways (6 topics).

Irrigation (11 topics).

Volume III.—Railways (7 topics).

Volume IV.—Municipal Engineering (8 topics).

Volume V.—Materials of Engineering Construction (20 topics).

Volumes VI. and VII.—Mechanical Engineering (28 topics). Electrical Engineering (8 topics).

Volume VIII.—Mining Engineering (10 topics).

Metallurgy (10 topics).

Volume IX.—Naval Architecture and Marine Engineering (19 topics).

Volume X.—Miscellaneous.

The general fee for membership in the congress is \$5, which will entitle the member to receive the index volume and any single volume of the transactions which he may select, together with the right of participation in all general activities and privileges of the congress. Other volumes may be secured at prices ranging according to the quantity taken. For \$30 one may secure a complete list of publications bound in cloth.

### Prince Rupert Plant Ready to Operate

In 1911 the citizens of Prince Rupert passed a by-law to raise money for the purpose of installing a combined gravity water supply and hydro-electric development. Prior to March of the present year nothing had been done on the electrical end of the project and the water system was only partially completed. The council, at this time, ordered the completion of the combined undertaking. Owing to a landslide which had taken place on the pipe line right-of-way it was necessary to abandon the original surveys and lay out a comparatively new route for the pipe line. The work was taken in hand by the city engineer and the city electrical superintendent Mr. T. C. Duncan, E.E. Contracts were let for the pipe to Gerald Lomer, Limited, the specials to the Mannesmann Tube Company, the turbine to the Canadian Allis-Chalmers and the generator and electrical equipment to the Canadian General Electric Company. The transmission line material was supplied by the Northern Electric Company.

A concrete dam has been constructed across the mouth of the creek which drains Woodworth Lake, about seven miles from the city. This lake has an area of 454 acres and will provide ample storage to carry the plant over the dry season. A 45-inch lap welded steel pipe has been laid between the dam and the power house, a distance of 7,800 ft., an 18-inch branch of the same class of pipe being taken off at a point immediately above the power house and laid to connect up with a cast-iron pipe crossing the passage between the mainland and Kaien Island on which Prince Rupert is

situated, this pipe being 13,000 ft. in length. The whole of the work has been carried out by city labor.

The generating plant installed consists of a 1,650 h.p. turbine and a 1,125 kv.a., 4,400 volt generator. The transmission line is built on wood poles with the exception of the crossing from the mainland to the island, a distance of 925 ft. in which two steel towers are employed. The power is transmitted at the machine voltage, extra equipment being installed at our city steam plant which will now be used as a sub-station and auxiliary plant. The system employed in the city distribution lines is 3-phase, 4-wire, with 2,500 volts between primary and neutral. We use standard single-phase transformers and supply all lighting and single-phase motors at 115 volts and 3-phase power at 220 volts.

The work is practically completed. Testing out of the pipes and machines is now being carried out and it is expected that operation will commence in a few days.

### Power Generated in Canada

The Commission of Conservation of Canada is endeavoring to make a complete inventory of the amount and kind of power used at every point in Canada, and to this end question blanks are being distributed. This is a most important undertaking, and one that should receive the co-operation of every power user. One of the difficulties will be that the list of power users in the hands of the Commission may not be, and likely is not, complete. Any power user who gets one of these blanks would, therefore, be materially assisting in this valuable work, if he would forward to the Commission the names of other power users in his district and especially if it should come to his attention that any of these are not on the government list.

Possibly some readers of the Electrical News who may not receive a copy from the Commission are in a position to supply information. With this in mind, we are reproducing the letter and accompanying blank form in full. The regular blank can be had on application to the Commission or the form herewith may even be torn out and forwarded, properly filled in, to the secretary at Ottawa. The main idea we ask our readers to keep in mind, however, is that the Commission needs the help of every individual power user to make this list complete, otherwise the effort will lose much of its value. The letter follows:—

Ottawa, November 4th, 1914.

Dear Sir:—

The Commission of Conservation is compiling data respecting power used in Canada. You doubtless recognize the importance of such an inventory to power users and to manufacturers generally, and I trust you will furnish me with the following information regarding the power used at your plant at as early a date as possible. The information may be inserted on the blank spaces opposite the questions on this sheet and, if returned in the enclosed envelope, will come post-free. While the questions asked are drafted so as to include the different kinds of power used, nevertheless should they not cover fully **the kind of power and manner of application at your plant**, I shall be obliged if you will supply the additional information under **Remarks**.

1. (a) Name of firm . . . . .
- (b) Place where located . . . . .
- (c) Products manufactured . . . . .
2. Motive Power Used.
  - (a) Water-power, horse-power used . . . . .
  - Number of days used per year . . . . .
  - (b) Electric power, horse-power used . . . . .
  - Number of days used per year . . . . .
  - (c) Steam-power, horse-power used . . . . .
  - Number of days used per year . . . . .
  - (d) Gas engine, horse-power used . . . . .
  - Number of days used per year . . . . .
  - (e) Oil engine, horse-power used . . . . .
  - Number of days used per year . . . . .
3. Water-Power.

If water-power is used and you generate your own power, please state:—



- (a) Head utilized ... ft. and name of river ...  
 (b) Number, type and horse-power of each water-wheel ...  
 (c) Amount of surplus power at lowest stage of stream ...  
 (d) Amount of deficiency of power at lowest stage of stream ...  
 (e) Approximate cost of power per horse-power per year ...
4. Electric Power.  
 If you generate your own power, please state:—  
 (a) Quantity generated ...  
 (b) Approximate cost per horse-power per year ...  
 If you purchase electric power, please state:—  
 (a) The number of horse-power purchased ...  
 (b) Approximate price paid for power ...  
 (c) Name and address of company from whom purchased ...  
 State number of motors used at your plant and horse-power of each ...
5. Steam-Power.  
 If steam-power is used, state:—  
 (a) Quantity and kind of coal used per year ... and cost per ton ...  
 (b) Quantity and kind of wood used per year ... and cost per cord ...  
 (c) Quantity of other fuel used and price ...  
 (d) Types of boilers used (return tubular, flue or water-tube), number and horse-power of each ...  
 (e) Types of steam engines used (simple, compound, compound condensing or turbine), and horse-power of each ...  
 (f) Approximate cost per horse-power of power generated ...
6. Gas Power.  
 If gas engine is used, do you make your own gas or are you supplied by a local company ...  
 What rate do you pay per 1,000 cu. ft. ...  
 If producer gas is used, state:—  
 (a) Kind and price of coal per ton ... and amount used per year ...  
 (b) Type of producer (suction, down draft, etc.) ...  
 (c) Approximate cost of power per horse-power per year ...  
 (d) Does the plant give satisfaction ...
7. Oil Engine.  
 If gasoline or oil engine is used, state:—  
 (a) Price of gasoline per gallon ... and amount used per year ...  
 (b) Kind of oil used ... price per gallon ... amount used per year ...  
 (c) Approximate cost of power per horse-power year ...  
 (d) Does the engine give satisfaction ...  
 Remarks: ...

If you desire that any information be considered as confidential, kindly indicate such portion.

Yours truly,

James White,  
 Assistant to Chairman.

### Still Lower Rates

The Public Utilities Commission has inaugurated new rates in London, Ontario, following the recommendation of the Hydro-electric Power Commission of Ontario. Apparently these are the lowest rates given to any municipality in the Hydro area. Up to the present time London has given an optional flat rate as well as the regular rate according to the commission's standardized plan. The flat rate is now done away with. The rates in effect from December 1st, 1914, are as follows:—

Domestic lighting—3 cents per 100 square feet of floor space with a minimum of 1,200 feet, and a maximum of 2,500 feet, plus a meter rate of 2 cents per kw. hour. A 10 per cent. discount is allowed for prompt payment.

Commercial lighting—5 cents per kw. hour for the first 30 hours use of installed capacity, 2 cents per kw. hour for the next 70 hours use and  $\frac{3}{5}$  of a cent beyond that amount. Discount 10 per cent.

## How Many More Lives?

Winnipeg, December 1st, 1914.

The Editor,

Electrical News,

Sir,—I have read with much interest your editorials on the above subject, and heartily commend your action in drawing attention to the matter. I fully thought the various operating companies and municipalities in Canada would show considerable activity following the recent decision of the Quebec courts, wherein the supply company was assessed with some \$26,000 damages and costs for neglecting to ground their secondaries. As to your suggestion that the matter should be discussed by the engineering bodies—that, to my mind is superfluous—no engineer of standing, I venture to say, can be found to-day to discourage the grounding of low tension secondaries. What is the greatest surprise to me, is that the Hydro-electric Power Commission is displaying such apparent indifference in this matter. In their admirable set of rules—Section E, page 113—the grounding is made mandatory, and considering the fact that these rules were apparently drawn up and adopted with the idea of paying greater attention to the question of life hazard than the National Code devoted to the subject, the Commission's apathy is, to say the least, remarkable. I also fail to understand the lack of interest displayed by the Fire Underwriters—surely this body, in view of the strenuous fight they put up in Quebec in the above quoted case, might be expected to take some part in bringing pressure to bear on the authorities with a view to enforcing the provisions of the "Code" in this respect. No doubt the war will be used as an excuse by most people for delaying action, but if the urgency of the matter could be realized, any governing body should be prepared to order this work to be undertaken in the public interest. One of the leading professors of electrical engineering in Canada recently expressed his opinion on the matter, and it was to this effect: "any company or corporation that neglected to ground its secondaries was guilty of criminal negligence." How many more lives will have to be sacrificed before this is realized? Probably a legal action or two decided against the wire-owning corporations will be the quickest way to arouse them as to their obligation to the public in this respect.

Yours truly,

(Signed) H. M. Smith.

## Our Christmas Duty

The Electrical News wishes its readers the best of Christmas cheer and happiness that is possible under the existing conditions of cruel and barbarous warfare, into which many of our own loved ones have been drawn. We cannot hope to be merry or happy in the usual Christmas sense, but we can indeed be truly grateful for the encouraging tone of the leaders of our armies and confident of an ultimate successful issue of the war: confident, too, that our trade conditions are already past their worst and that, with the ending of the war, Canadian industries are surely due for a rebound into unprecedented activity.

Our duty plainly is to see to it this Christmas that no citizen of Canada lacks the means of being grateful. In ministering to those less fortunate, we may in part forget the hideous cause of much of our misfortune.



## Economics of Municipal Plants

By Mr. H. K. Dutcher, before the recent convention of  
British Columbia Municipalities

There seems now a general tendency on the part of the towns and cities throughout the Dominion to have municipal electric power plant and distribution systems in preference to having these systems controlled and operated by corporations, and while there has been in the past a pronounced weakness in the management of some municipal plants, a marked improvement is noted in this respect where the control of such systems is placed under a commission or board of commissioners. In fact, the recent annual reports on the operations of almost all the municipal systems in Western Canada would indicate that some of these plants are operated with a degree of thoroughness in cost keeping and commercial development which compares favorably with the best corporation plant systems. Where the operation of a company system is subject to severe criticism in the matter of rates or service of the systems it is fair to state that in some cases the condemnation of the companies is not always justified where investments have been made in the face of the most discouraging conditions of construction with plant becoming obsolete before its time by reason of the experimental stage of the science, and the pioneer period of development which has marked the growth of western towns. On the other hand where the rates are unreasonably high, and it is inconvenient or not possible to take over a system under municipal control, it is sometimes possible to obtain the desired reduction in rates by introducing competition at a reasonable expenditure in a municipal plant designed for enlargement from time to time as may appear desirable to extend the field of competition.

### Typical Examples

For example, the City of Montreal is served with electric light, power and electric railway systems by two strong companies, which control practically all of the available water powers near the city. Through the condition of early combination, watered stock and reorganizations, the dividend returns on stock are only ordinary, notwithstanding the cheap source of power and high rates to the consumer. About ten years ago the City of Westmount, a suburb of Montreal, established a small municipal steam plant to compete with the company within its limits, with the result that the people in Westmount were able to obtain electric light and power from either the municipal power plant or the company system at about half the rates charged to consumers in Montreal.

In Ontario the Hydro-electric Commission was formed in 1906 to carry out a scheme of cheap power distribution to the towns of the lower peninsula, and the work of this commission is rapidly spreading over the more populous section of the Province with the result that the Hydro-electric resources of the Province, including the development at Niagara, are affording cheap power for the numerous towns within range of the system to an extent which is now fully appreciated by the consumer and the annual reports of this commission indicate the remarkable results obtained and the efficiency of their work.

The City of Winnipeg a few years ago undertook the construction of a hydro-electric plant to compete with the company plant then serving the consumers, and by the competition of the municipal plant the ordinary rates of electric light have been reduced from 20c per kw.h. to 3c per kw.h., this rate being about the lowest for any city in America.

Assuming even a company rate of 12c per kw.h., and a total consumption of 30,000,000 kw.h. per year, the reduction to 3c per kw.h. represents a saving to the citizens of over \$2,000,000 per year which appears to well warrant the investment of \$6,000,000 in the municipal plant.

In the smaller cities of the Middle West where hydro-

electric power is not available or economical, the municipal plants generating power by steam or Diesel oil engines are permitting maximum lighting rates of about 7c per kw.h., which rates may be further reduced by the increased demand.

In the case of Calgary the municipal system is supplied with power both from a municipal steam plant and hydro-electric power from the Bow River Power Company, the municipal plant serving as a reserve and auxiliary supply of power to the water power plant. It enables the city to obtain power in bulk from the company at rates only possible by the possession of the municipal plant; while the prospect of the city obtaining a hydro-electric development of its own will probably place the city in a still better position with respect to power.

### Low Rate in Seattle

In British Columbia the municipal plant systems are so far confined to the smaller towns, and the rates are somewhat higher than the rates prevailing in the East and Middle West. On the coast, it is interesting to note that both Seattle and Vancouver are served with hydro-electric power, Seattle having a municipal plant and Vancouver a corporation plant system. In Seattle, however, the maximum rate to the consumer is 6c per kw.h., while the Vancouver rates are about double this charge. But before the city of Seattle entered into competition with the company system the maximum rate there was 20c per kw.h., and when the municipal plant was projected in 1902 the company then reduced its rate to 12c, and finally to the same rate as the city when the plant was placed in operation.

In most cases it will be found that for small towns the annual consumption of power will be from 150 to 200 kw.h. per capita. For example, Vernon requires about 50,000 kw.h. per month, or 600,000 kw.h. per year, of which about 15 per cent. is for street lighting. On the other hand, Kamloops, with a population of about double that of Vernon, requires as much more for the pumping plant and power service.

A combined hydro-electric and steam power plant system is now completed for the city of Kamloops at a total expenditure of nearly half a million dollars. The steam plant was completed last year and is designed to act as a reserve or auxiliary plant and pumping station with initial installation of steam turbines for 2,000 h.p. capacity the fuel to be either coal or oil.

### Kamloops Well Supplied

The City of Kamloops has therefore an assured source of cheap power to provide for all requirements well into the future. When studying the present and future needs of the city with respect to electric power, the following facts were noted. The City of Kamloops by reason of its location at the junction of two important rivers and two transcontinental railway systems, was rapidly assuming the position of the Spokane of British Columbia. The need was apparent, however, of cheaper power, and greater agricultural development along both river valleys. With coal of an indifferent quality costing over \$4.00 per ton the prospect of cheaper power from a steam plant was not apparent since the expenditure for fuel alone would cost about 1.3 cents per kw.h., or over \$30,000, for this year's consumption of power.

Since, however, as is the case of practically all water power plants in Canada where winter conditions are more severe, the steam plant was built as a necessary part of the system to act as a reserve or auxiliary plant. It is, therefore, necessary to include the annual charges on the steam plant. Thus taking the combined plant with a capacity of 4,000 h.p. the total charges are estimated at 58,910.

While very little has yet been done by Vancouver, Victoria and the municipalities surrounding these towns with respect to municipal power plant systems, there has nevertheless been developing a certain amount of interest in this direction and reports have been submitted dealing with the



problem of securing water rights for future power development and undertaking the construction of steam plants to provide for the present requirements and fit in with the future scheme of hydro-electric power.

Where a municipality undertakes the responsibility of operating a municipal power plant system it is well to remember that it is better to invest a few thousand dollars in perfecting that system than to lose an equal amount through waste of fuel, supplies, materials, or through mistakes which may have to be remedied at considerable cost. In fact, no matter how well built a plant is, the results obtained will largely depend on the efficiency of the operating staff and the co-operation of all concerned towards establishing that esprit de corps so necessary to the success of any enterprise.

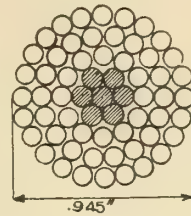
## Aluminium Transmission Lines

The table presented herewith makes no claim to being complete, but is a compilation from various sources of the more important hydro-electric undertakings in North America which are employing aluminium cables on their transmission lines. Some features of the table are of particular interest. It will be noted that the longest transmission lines in the world, viz., the Pacific Light and Power Corporation (Los Angeles-Big Creek), the Southern Sierras Power Company (Bishop-San Bernardino), and the Hydro-electric Power Commission of Ontario (Niagara-Windsor), are all using aluminium wholly or in part. It will be observed that seven and nineteen wire cables are the rule. Owing to the fact of the light metal being more flexible than copper, fewer strands are necessary.

Five systems, it will be noted, are trying out the steel centre aluminium cable, in which the tension of the line is carried by a core of high carbon steel wires, around which are laid the aluminium wires. This type of cable can be strung with somewhat smaller sags than straight aluminium and so shorter and cheaper towers can be used. The line tension windage and loading on the towers are increased, however. Columns 9 and 10 of the table are interesting as showing that on no less than fourteen systems spans exceeding 1,000 feet in length are being run with aluminium.

Some idea of the importance of this vigorous young competitor of copper can be obtained by totalling up the

weights given in the table. It will be seen that the total in use, or specified, aggregates twenty-four million pounds. Owing to the weight ratio of two to one, the quantity of copper displaced by this aluminium is just forty-eight million pounds. In connection with the Mexican Northern data it



Cross-section of 61 strand cable, correct size—Seven central strands are steel.

should be stated that the figure of 630 tons represents the ultimate total; the line at present under way will have a weight of only 320 tons.

The line cut reproduced herewith represents a cross-section of the Pacific Light & Power Company's 61-strand cable. Of the total number of strands the seven central ones are steel, leaving 54 of aluminium.

### Nelson-Vancouver Telephone Service

As the result of a visit paid by British Columbia Telephone Company officials to Nelson some time ago that city is likely to secure telephone connection with Vancouver and other Coast points in the near future. A trial conversation was carried on with Vancouver Exchange via Spokane and Seattle, when the results were so satisfactory that a service will likely be instituted in the not distant future. The test was made by George H. Halse, general manager of the company, and F. C. Bolschweiler, general superintendent. It was also decided to lay a new cable across the West Arm of Kootenay River at Proctor to connect up the company's Nelson-Balfour line with the Dominion Government's line to Kootenay Landing. It is also proposed to connect Nelson and Kaslo by a direct line which will be an extension of the system between Kittos and Balfour, completed about six weeks ago. The service between Nelson and New Denver is also marked for improvement and the line from Rossland to Patterson is to be rebuilt in order to give improved transmission to Grand Forks and other points in the boundary country.

### DETAILS OF TRANSMISSION SYSTEMS IN AMERICA USING ALUMINIUM CONDUCTORS.

Country	System	Miles	Volts	Wires	Size C.M.	Strands	Core	Span Stand.	Tons of Alum'm
Alberta	Calgary Power Company	50	50,000	3	133,100	7	Al.		50
British Columbia	Vancouver Island Power	40	40,000	3	133,100		Al.		40
California	Pacific Light & Power	275	150,000	6	605,560	61	St.	660	2480
California	Pacific Gas & Electric	109	110,000	6	267,000		Al.	660	440
California	Pacific Gas & Electric	500	60,000	3	Various	Var.	Al.	125	1500
California	San Joaquin Light & Power	650	(30,000 60,000)	3	Various	Var.	Al.	350	1700
California	Southern Sierras Power	238	140,000	6	211,600	7	St.	660	1500
Connecticut	Conn. Power Company	77	33,000	3	167,800	7	Al.		96
Connecticut	Conn. Power Company	23	33,000	6	105,600	7	Al.		36
Georgia	Cent. Georgia Trans.	34	66,000	6	167,800	7	Al.	550	1100
Georgia	Cent. Georgia Power	59	66,000	6	176,000	7	St.	500	156
Illinois	Chicago San. District	30	44,000	9	280,000	19	Al.	350	190
Manitoba	Winnipeg City Light & Power	77	66,000	6	278,600	19	Al.	500	940
Mexico	Mex. Northern Power	157	110,000	6	280,000	7	Al.	575	1100
New York	Cedars Rapids Mfg. & Power	60	110,000	6	500,000		St.	660	450
New York	Niagara, Lockport & Ontario	180	60,000	6	500,000	19	Al.		1250
New York	Northern Power Co.	60	80,000	6	105,600	7	Al.	550	94
North Carolina	Southern Power Co.	210	100,000	6	Various	Var.	Al.	550	1600
North Carolina	N. C. Elec. Co.	80	88,000	3	105,600	7	Al.	300	62
Ontario	Hydro-electric Comm'n.	700	110,000	6	Various	Var.	A/S	550	1100
Ontario	Nipissing Power Co.	20	22,000	3	66,360	7	Al.		10
Ontario	Simcoe Railway & Power	25	22,000	3	105,600	7	Al.		25
Oregon	Mt. Hood Railway & Power	42	57,000	3	167,800	7	Al.	132	55
Oregon	Portland Rly. L. & P.	30	60,000	6	250,000	19	Al.	500	1800
Pennsylvania	Pa. Water & Power Co.	40	70,000	12	300,000	19	Al.	500	1280
Quebec	Shawinigan W. & P. Co.	85	100,000	6	250,000	19	Al.	600	1400
Washington	Wash. Water Power Co.	177	60,000	3	270,000		Al.	250	910
Washington	Whatcom Co. R. & L.	42	60,000	3	139,000	7	Al.	135	44
West Virginia	Appalachian Power Co.	200	88,000	3	105,600	7	Al.	250	1200
Washington	Puget Sound Traction	142	55,000	3	211,600	7	Al.	175	450



# Power Supply in Ontario's Mining Districts

## Description of the New Compressor Plant of the Canadian Mining and Finance Company, Timmins, Ont.

By Mr. H. E. Mueller

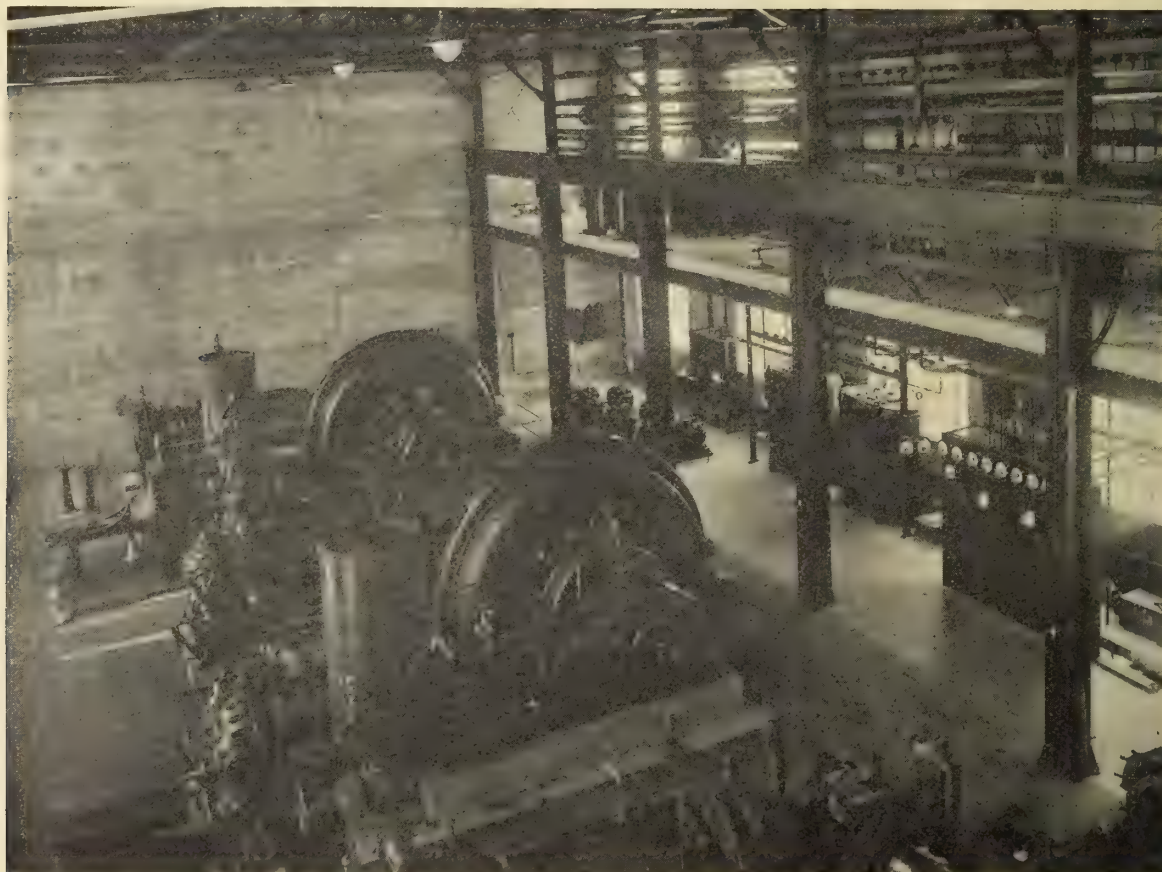
The increased interest taken in this district, undoubtedly caused by the remarkable success and good showings at a number of mines, has warranted, and practically demanded, an increase in capacity of mining and milling apparatus at such properties. The original apparatus has long since been laid aside as too small, and has been replaced with machinery of greater capacity, which, in turn, has been added to, or again enlarged by replacing, and so on, as the property became developed.

In the early part of 1911, power for driving this machinery was obtained through steam. In the fall of the same year, power was first transmitted from a hydro-electric sta-

motors, direct-connected to horizontal air compressors which supply air at about 100 lbs. pressure to the mines of this company (Hollinger, Acme, Miller, Middleton).

### Power House

The power house, a steel frame with reinforced concrete walls and roof, is 170 feet long, 53 feet wide and, neglecting basement, 34.6 feet high. It is divided into two sections, the compressor room and the boiler house. The former, 119 feet long, contains the air compressors and electrical apparatus, and a 20-ton travelling, hand-operated crane. The latter section contains the boilers, electric and steam pumps. Both sections are liberally fitted with large steel frame win-



Interior of new motor-driven compressor plant—2500 h.p. capacity.

tion on the Mattagami River. Since then the steam drive has been replaced, wherever possible, with electric motors. The development of a second waterfall on the same river added to the available power, so that at the present time nearly 10,000 horsepower of electrical energy is being supplied by these plants for light and power at the mines and various towns. The hydraulic end of the above plants has lately been entirely remodelled and reconstructed and they are now in a more serviceable condition than previously.

The latest and largest step in the line of increasing of mining capacity is now nearing completion in the new power house of the Canadian Mining & Finance Company, situated on the shores of Gillies Lake, Timmins, Ontario.

Power is supplied by the previously mentioned plants at about 11,500 volts and is used at this potential by synchronous

dows. Ventilation is obtained through these windows, and four ventilators on the roof.

The present installation will consist of three 770 h.p. synchronous motors, direct connected to air compressors rated at 4,600 cu. ft. per minute, four 350 h.p. vertical water tube boilers and steam and electric pumps for feeding boilers and cooling compressors. Space has been allowed in the compressor room for additional compressor units for future installation.

### High Tension Layout

A three-phase high tension line runs to the lightning arrester house, situated about 100 feet from the power house. The service taps from the power house meet this line at an angle of less than 45 deg. at the arrester house. This is to serve as an "inducement" for the lightning and line surges



to "get off" at the right place. Directly inside the station the line runs through a set of disconnecting switches and choke coils, thence to the main oil switch, situated on the high tension gallery located on one side of the compressor room over the control board. The running switches of the motors, auto-transformers, step-down transformers for exciting and power purposes, and potential transformers, are all tapped from a general bus fed through this main switch.

The auto-transformer switch controls a bus to which two auto-transformers are connected, the secondary sides of which are tapped to another set of buses, to which the starting taps of the motors are connected. The secondary side of one transformer is left disconnected and will be used for spare.

All the high tension self-contained oil switches, disconnecting switches, series transformers, bus bars, etc., are rigidly mounted on an angle and channel iron framework.

#### Electrical Apparatus

Three 770 h.p., 125 r.p.m. synchronous motors with two auto-transformers, three motor generator exciter sets, oil switches, switchboard, lightning arresters and other accessories were supplied by the Canadian Westinghouse Co.

The extra heavy type of rotor on these motors makes a separate flywheel unnecessary. Heavy low resistance rings encircling both sides of the field poles, inter-connected at each pole with copper bars slotted in the pole face, practically eliminate all "dead points" in starting and serve as dampeners during operation. Each motor is rated at 770 h.p. with a k.v.a. input of 608, making the efficiency at full load and unity power factor 94.5 per cent.

Two auto-transformers rated at 1200 kw. 11000/9550/5750 volts, are situated to the left of the switchboard on the compressor floor.

The three motor generator exciter sets, mounted in individual cast iron bed plates, to the left of the auto-transformers, are each 3 phase, 550 volt, 1400 r.p.m., 22 h.p. squirrel cage induction motors, with 125 volt, 120 amp. compound wound generators with interpoles. Each set is equipped with a starting compensator with no voltage release. Motors are protected with fuses. The equalizer is brought with the positive and negative conductors to buses on the rear of the control board, through triple pole, double throw quick break knife switches.

Each motor panel is fitted with an a.c. ammeter, d.c. ammeter, power factor meter, recording wattmeter, two double pole, double throw knife switches, one of which has a field discharge resistance attachment, and three operating levers for the starting and running switches of the motors.

The upper point of the field switch is connected to the central point of the double throw master switch, whose upper and lower positions are connected through the buses to the corresponding positions on the main exciter switches on the exciter panel. The lower position of the field switch is short circuited and used in this position while starting. The running switches are each equipped with inverse time limit overload relays which are mounted directly under the circuit breakers. A graphic recording wattmeter and an a.c. ammeter, mounted on the feeder panel record and indicate the total power consumption.

On the high tension gallery are situated two banks of single phase, oil insulated, self cooled transformers, three to each bank. One bank rated at 45 k.v.a. will be used exclusively for the motor generator exciter sets. The second bank, which also has a secondary voltage of 550, will be used for light and power. Two single phase, 75 k.v.a., 550/110 transformers connected in open delta, step the voltage down for lighting.

#### Illumination

A row of eight, one thousand candle power nitrogen-filled lamps, with diffusion globes and reflectors, mounted

under the roof structures, together with fourteen 100 watt tungsten lamps mounted in brackets under the crane track, are used to illuminate the compressor room. The 100 watt lamps in the brackets, aided by the powerful nitrogen-filled lamps, reflecting from above and into the centre, practically eliminate all shadows. The switchboard and high tension gallery are well illuminated with 100 and 250 watt lamps.

Below each bracket along the crane track is a plug-in receptacle for extension lamps. All conductors for light and power are run through rigid conduit.

#### Air Compressors

Two of the three air compressors are of the Nordbery Manufacturing Company make and are so designed and equipped that they can be used as steam engines in event of failure of power or lack of power supply. The motors will then be run as generators and will supply the third compressor and various mill motors with electrical energy. It is estimated that to change over as above described will take less than half a day. This includes firing of the boilers, which will have a forced draft.

A feature on the third compressor (Fraser & Chalmers) is an automatic pressure regulating device, which opens a relief valve on each compression stroke of the high and low pressure cylinders, when the pressure becomes excessive. On opening, this valve by-passes a quantity of air from one end of the cylinder to the other or from the compression to the suction stroke, causing a drop in its output and the amount of power consumed. This drop is generally gradual, and differs in amount according to the dropping of the air load in the compressors. When the pressure commences to lower, the relief valve cuts off the amount of by-passing air and the compressor is slowly loaded. In this way it loads and unloads itself in a gradual manner, resulting in no noticeable fluctuation in voltage or frequency on the line.

The unloading device on many compressors, on the pressure reaching a pre-determined high value completely cuts off all air to the compressors, resulting in the sudden drop of nearly all load on the motor. Then when the pressure reaches its low value the governor opens the air inlet wide and the motor is immediately fully loaded. The frequency and voltage fluctuations caused by this loading and unloading are naturally quite noticeable, particularly on small systems.

#### Starting Compressors

When starting a unit, valves releasing the air from the cylinders to the atmosphere are opened, thus preventing a rise of pressure and an unnecessary load on the motor. The field switch is then thrown to its lower position, short circuiting the field (rheostat having been adjusted to allow flow of about 50 amps. through the field). After energizing the auto-transformer the first step to the motor is closed and it starts up taking about 70 per cent. over rated current for a short period. The total time required between closing the first step and the running switch averages about 40 seconds.

Two units are at present in operation. The third unit is expected to be ready in late December or early January.

#### Rural Telephone Improvements

The British Columbia Telephone Company's system connecting up Fraser Valley with Vancouver has been improved by the stringing of high aerial wires across the Fraser River at Mission to replace the submarine cable, which was constantly being interfered with by the changing bed of the river and the snags carried down by the current when the river was in flood.

A new circuit recently completed gives Port Moody citizens direct telephone communication with Vancouver. Previously the route was by way of New Westminster.



# Data on Long Transmission Lines

## Some Comparisons of the Phenomena Observed on a 143 Mile Line and a 240 Mile Line—Distance Limits Being Approached

By Mr. R. A. Philip

Two long transmission lines have recently been completed by the Stone & Webster Engineering Corporation. The first, from Keokuk to St. Louis, is 143 miles long; and the second, from Big Creek to Los Angeles, is 240 miles long. A comparison of these two lines shows how increased length modifies line phenomena and that line lengths are approaching a limit where ordinary methods of operation must fail.

The Keokuk line comes within the range of customary methods, but the electrical design of the Big Creek line presents a different plan of operation which indicates the direction in which the design of the longer lines of the future may be expected to tend as the new difficulties become more pronounced.

On long transmission lines it has been noted that the voltage at the delivery end has invariably been higher than at the generating end when the line is carrying no load. Theory indicates that this is also true for short lines but that the amount of rise is inappreciable and may, therefore, be neglected. Within ordinary ranges the rise increases as the square of the length of the line, that is about 41 per cent. increase in length doubles the rise. On short lines this is unimportant, on the principle that the double of nothing is also nothing. On longer lines the change from a small but appreciable rise to a large and serious rise is rapid.

The rise of voltage in a transmission line is a special case of what occurs when a relatively small condenser is charged with alternating current through an inductance. The voltage across the terminals of the condenser rises to a higher value than the applied voltage. The percentage rise obtained depends on the relative amount of capacity and inductance. One particular relation between capacity and inductance produces the phenomenon called resonance, where the rise becomes indefinitely great.

In a transmission line the percentage rise of voltage depends almost entirely on the length of line and the fre-

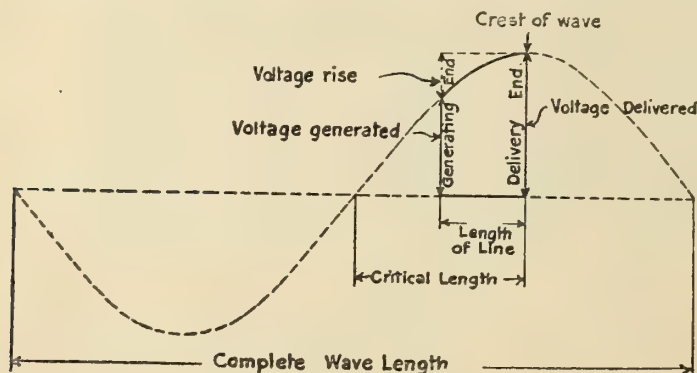


Fig. 1

quency. The voltage used has no effect on the percentage rise, that is to say, the 110,000 volts used on the Keokuk line and the 150,000 volts on the Big Creek line do not produce greater percentages of rise than would occur were the lines charged with 110-volt current from a lamp socket. The number of volts rise is, of course, greater for the higher voltage; for 10 per cent. of 150,000 volts is 15,000 volts, while 10 per cent. of 110 volts is only 11 volts. The resistance of the wire, its size and spacing are comparatively unimportant factors and for present purposes it is sufficiently accurate to say that they make no difference.

As lines grow longer, the capacity reactance decreases and inductive reactance increases with consequent increase in voltage rise. One particular length of line gives the relation which produces resonance. If voltage is applied to a line of this length it will build up indefinitely, that is, until something happens. The voltage may increase until the insulators arc over or puncture or the charging current may become great enough to burn out the generator. If the source of supply is feeble, the building up may be limited by the dissipation of the available energy in line loss.

The length of line which produces resonance depends

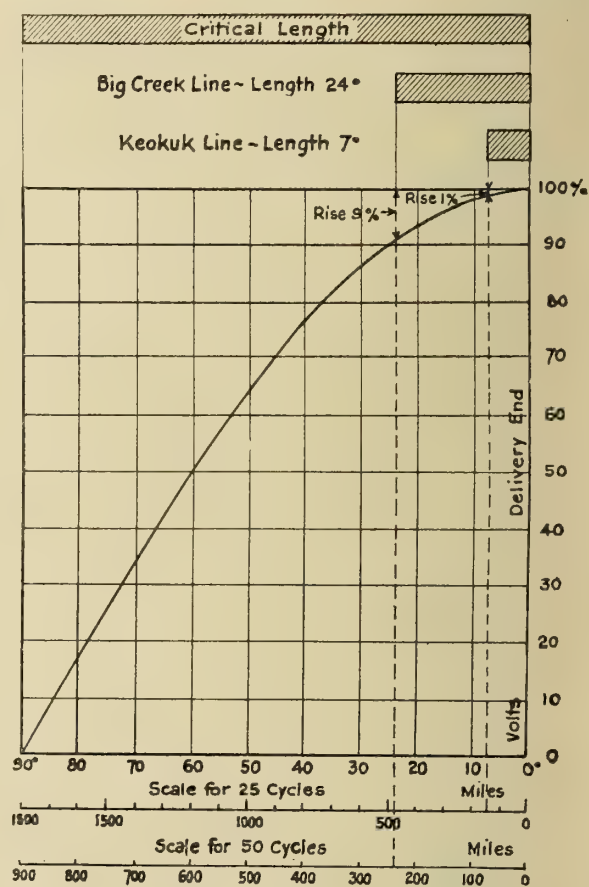


Fig. 2

on the frequency alone, that is, for each frequency there is a critical length where resonance occurs. The critical length may be computed by means of transmission line formulae but a different method gives a short cut.

Electric phenomena are transmitted with the velocity of light, that is, about 180,000 miles per second. In an alternating current of say 60 cycles per second, the "front end" of a cycle has 1/60 of a second start over the "rear end." With 1/60 second start and traveling at 180,000 miles per second, the beginning of one cycle will be 3,000 miles away when a new cycle is ready to start. This is expressed briefly by saying that a 60-cycle current has a natural wave length of 3,000 miles. The wave length for other frequencies are inversely as the frequency: 7,200 miles for 25 cycles, 3,600 miles for 50 cycles, etc.

The length of line which produces resonance is found to be one-fourth of the natural wave length; or 1,800 miles for 25 cycles, 900 miles for 50 cycles and 750 miles for 60



cycles. These lengths are then the critical lengths for these frequencies.

In a line of critical length ordinary methods of operation must fail for it is impracticable to charge the line with the receiving end open. The critical length, therefore, furnishes a measuring stick for determining whether a line is long or short. When the critical length is so far off that it may be disregarded, the line may be classified as short; while a line long enough to require those precautions which are essential in the vicinity of the critical length is a long one.

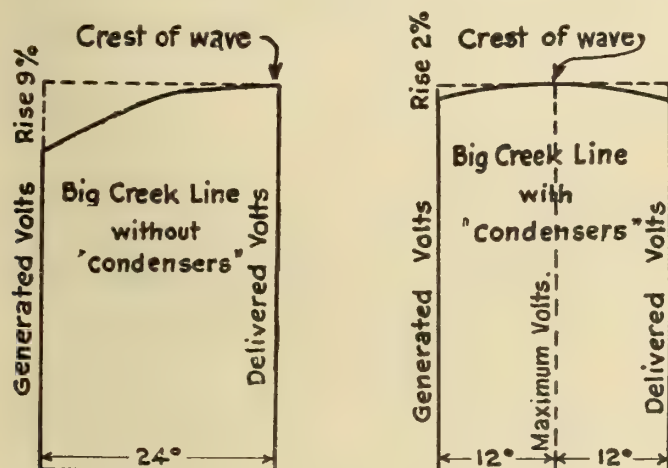


Fig. 3

On this basis, the Keokuk line is short but the Big Creek line is nearly, if not quite, long.

In comparing the electrical characteristics of lines of different frequency the relative length in miles does not furnish as good a basis as the proportion each is of its respective wave length. The wave length is an inconveniently large unit so that, like a circular arc, it may be considered divided into 360 degrees to give a convenient unit. For electrical purposes the length of transmission lines may, therefore, be better stated in degrees than in miles. At a frequency of 25 cycles each 20 miles is one degree of length, at 50 cycles each 10 miles and at 60 cycles each  $8\frac{1}{3}$  miles is a degree.

On this basis of comparison, the length of the 25-cycle Keokuk line is about 7 degrees, and the 50-cycle Big Creek line about 24 degrees. The critical length in all cases being 90 degrees.

At no load the voltage rises along a transmission line in proportion to a sine wave, the delivery end always being at the crest of the wave (Fig. 1). This makes the relation between generated and delivered voltage very simple. Taking the delivered voltage as unity, the generated voltage is proportional to the cosine of the length of the line expressed in degrees. As the cosine of 7 degrees is .99 and of 24 degrees is .91, it follows that the generated voltage is 99 per cent. of the delivered voltage on the Keokuk line and 91 per cent. on the Big Creek line.

Fig. 2 shows a graphical basis of comparison for simple transmission lines in general of all lengths, frequencies and voltages, and shows the position occupied by the Keokuk and Big Creek lines respectively in comparison with the critical length.

Even on the Big Creek line the ratio of delivered to generated voltage is not so great as to require any extraordinary precautions. The diagram shows that for longer lines the delivered voltage will increase to double and triple the generated voltage and at the critical length the ratio is as one to zero, that is, infinitely great.

The Big Creek line, therefore, differs from the Keokuk line, not in requiring new methods because of the rise in voltage, but in providing methods, though for other reasons,

which would make the operation of a line of critical length possible.

The Big Creek line is a new departure in providing, at the delivery end of the line, synchronous condensers which are considered an integral part of the line design. In fact, the generators and condensers each with their voltage regulators are considered with the line as one unit of design. While the principal function of the synchronous condensers is to furnish leading current, thereby raising the voltage at the delivery end when the line is loaded, they have an almost equally important secondary function of furnishing lagging current for reducing the delivered voltage at no load. By raising the voltage at full load and lowering it at no load, the condenser makes it possible to maintain a constant voltage of 150,000 at each end of the line over the whole range of load. For present purposes it is sufficient to consider the effect of this plan at no load only.

With no load on the line (but with the synchronous condensers running because they are to be considered as a part of the line itself and not an external load) half of the charging current of the line will come from the condensers and half from the generators. Under these conditions the crest of the sine wave of voltage is no longer at the delivery end of the line but is moved to the middle of the line as shown in Fig. 3. This change is equivalent to substituting two separate lines each of 12 degrees of length for one 24 degrees long. The maximum voltage now occurs at the middle of the line and as the cosine of 12 degrees is about .98 the generated and delivered voltage will be about 98 per cent. on the maximum. That is, the rise of voltage has been cut down from about 10 per cent. to 2 per cent. of the generated voltage.

As before stated, the length of the Big Creek line is not sufficient to make control of voltage rise necessary, but the radical nature of the step taken in providing such control is apparent in the case of a line of the critical length. Under ordinary operating methods the rise on such a line figures as infinite and its operation impossible. With a condenser at the delivery end as part of the line, the length of the line is virtually reduced from 90 degrees to 45 degrees. As the

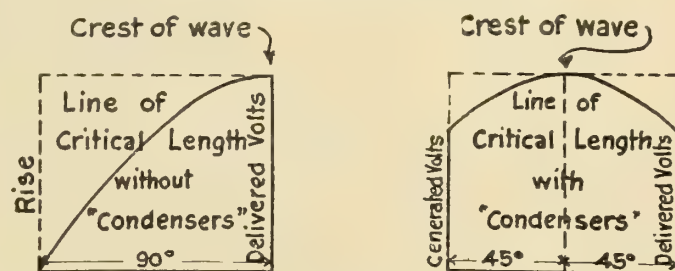


Fig. 4

cosine of 45 degrees is .71 the voltage at the ends of the line will be 71 per cent. of that in the middle, or the rise will be about 41 per cent. of the terminal voltage; a large but not impossible amount. Without condensers the delivered voltage would be infinitely greater than the generated voltage, while with the condensers the voltage at the two terminals would be equal as shown in Fig. 4.

The Big Creek plan, therefore, makes possible the operation of lines of the critical length.

The controlling of voltage rise is but one of the useful functions of the condensers. In so far as they are used for this purpose, they are not so very different from reactance coils and if this were their only function they might with advantage be replaced by such coils. That is, reactance coils connected in multiple with the transmission line at the delivery end or at intermediate points would properly hold down the voltage at no load, but would fail to raise the voltage at full load as is desirable.

Such reactive coils on a transmission line would be close-



ly analogous to the "loading coils" used on telephone lines, the purpose being substantially the same; that is, to neutralize the effect of the distributed electrostatic capacity of the line by adding a partially distributed inductance.

On telephone lines the problem was met much earlier than on transmission lines because of the higher frequencies used and the greater lengths of line operated. Taking 500 cycles per second as an ordinary telephone frequency, the wave length is but 360 miles and telephone lines over 2,000 miles long are in use. Thus telephone lines have already covered several complete wave lengths while transmission lines have not yet attained a length of one-quarter of one wave.

It appears that the long transmission line, like the long telephone line, will differ from the short line in being "loaded." The problems of "loading" transmission and telephone lines are not quite identical so that somewhat different solutions may be expected. The Big Creek line is probably the first systematically "loaded" power line and indicates that power line "loading" practice will diverge from telephone practice from the beginning. Telephone lines are "loaded" with coils of fixed inductance while power lines will probably be "loaded" with synchronous machines which will act as inductances at no load and as condensers at full load.

The Big Creek line is "loaded" at its terminals only and that is sufficient as the line covers only about one-seventh of a wave length. On longer lines intermediate "loading" may be desirable. For example, the quarter wave length line has a rise of 41 per cent. at the middle when "loaded" at the terminals. An additional "loading" at the middle would reduce this to about 8 per cent.

On still longer lines resonance may occur even with terminal "loading" so that intermediate "loading" will then be essential. Thus a line covering half a wave length may act as two lines of a quarter wave length if "loaded" at the terminals only. The voltage at the middle point would then build up indefinitely unless restrained by intermediate "loading."

#### Interior Districts Will No Longer Be Isolated

That the Dominion Government is earnestly pursuing its policy of linking up the isolated districts of the interior of British Columbia with the centres of population is shown by the fact that east of Ashcroft over 400 miles of new telephone lines, being constructed in Kamloops, Okanagan, Kootenay and boundary districts will give a total of 1,200 miles of government lines. The line from Golden to Windermere has been entirely rebuilt, the work comprising a new metallic circuit and up-to-date exchange at Golden, and local exchanges at Windermere, Atholmer, Invermere and Wilmer. Lines are also being built from Midway to Osoyoos, and from Fairview—the end of the present government line—to Oroville, which will give direct connection from the Cariboo lines through the Okanagan district to Oroville. From Nelson a line will extend to Trail and Waneta via Columbia Gardens. A central call office at Nelson will be connected with the local and long distance lines of the British Columbia Telephone Company.

Two Marconi wireless stations have been installed at the campus of McGill University, the apparatus having been loaned to the University by the Militia Department, supplemented by telephones, etc., by the Northern Electric Company. Twenty-nine students, mostly fourth year, taking the electrical classes, are receiving instruction in wireless telegraphy under Professors Gray and King and Mr. E. G. Burr. The students have all enlisted, this being a condition laid down by the Militia Department prior to loaning the apparatus. The men will thus be ready for active service if called upon.

#### Personal

**Mr. C. A. Howe**, formerly manager of the Holophane Company of Canada, has been appointed general sales manager for the George Cutter Company.

**Mr. James Hyde**, former superintendent of the Dorchester Electric Company, has rejoined the staff of the Montreal Light, Heat and Power Company.

**Mr. Frederic Nicholls**, president and general manager of the Canadian General Electric Company, has been appointed an honorary colonel of the Canadian militia.

**Mr. A. Gaboury**, Superintendent Montreal Tramways Company lectured recently before the Montreal Electrical Association on the subject of "Safety First." The Montreal Tramways Company have been active supporters of this movement.

**Mr. T. J. Kennedy**, president and general manager of the Algoma Central & Hudson Bay Railway and the Algoma Eastern Railway, Sault Ste. Marie, Ont., has also been elected vice-president and general manager of the International Transit Company and the Trans St. Marys Traction Company, in charge of street railways and ferries.

**Mr. F. D. Nims**, chief engineer of the Western Canada Power Company, Limited, has left that company to take up a similar position with the Olympic Power Company, Port Angeles, Wash. Prior to his departure Mr. Nims was the recipient of numerous testimonials, indicative of the prominent part he has taken in B. C. electric circles. Mr. Nims is a fellow of the American Institute of Electrical Engineers and has been very active in the operation of the Vancouver section of the institute.

#### Obituary

**Mr. F. C. Robertson**, Inspector of the Ontario Division of the C. P. R. Telegraph System, died recently at his home in Port Hope.

Following a brief illness, **Mr. Jas. A. Baylis**, chief engineer of the Bell Telephone Company of Canada, died recently at his home in Montreal. Mr. Baylis was born in Montreal in 1869 and gained his primary education in that city. He later attended the Worcester Polytechnic Institute, where he obtained his engineering degree. In 1890 he joined the staff of the Bell Telephone Company, and for the past 24 years, has held the position of chief engineer.

#### New Books

**School of Practical Electricity**—Published by the Electroforce Publishing Company, Milwaukee; price, \$4.50. This book is divided into a number of sections, each section written by an authority in that particular line of electricity. The authors are Oscar Warwath, E.E., George K. Kirchgasser, Frederick G. Raeth, W. P. Hennig and R. A. W. Tanns. The sections are:—principles of electricity, batteries and low potential electric wiring; theory of direct-current; electric light wiring with problems; magnetism and the commercial application of magnets; and telephony. The book is so written as to be readily understood by the student, electrician, engineer or architect. Numerous diagrams and illustrations are used throughout. Each section of the book is complete in itself, as is indicated by the section on electric light wiring, which has chapters devoted to the following:—electric circuits; insulation and capacity of conductors; interior wiring system, how installed; Underwriters' restrictions covering all wiring installations; wiring in special locations; fittings and accessories; switches and their connection for control from different locations, three-ways, etc. Practical problems in everyday wiring, wire splicing, etc. Sign lighting; complete wiring of a residence; and electric illumination.



# Electric Railways

## The Development of the Motor Bus—Of Proven Worth in Serving Outlying City Districts—Cheaper Both to Instal and Operate

At many points in the United States the use of motor buses is proving to be a very satisfactory solution of the transportation problem in the outlying districts, where traffic does not yet warrant the standard railway extension. As an example, the Cleveland Railway Company, Cleveland, Ohio, recently purchased three twenty-six passenger motor omnibuses, mounted on three-ton White chassis, from the G. C. Kuhlman Car Company.

raise. Directly in front of the driver's position, on the left side of the body, the sash is equipped with a glass shield, which prevents rain or snow interfering with his vision in stormy weather. Brill "Winner" seats, with stationary backs and upholstered in twill-woven rattan, arranged as shown on the diagram of the seating plan below, provide a maximum seating capacity of 26 for this size body. A section of the rear cross seat, directly in front of the emergency door, which may be operated by the passengers, is removable. The driver's seat, upholstered in leather, is located directly over the gasoline tank. The heating system is connected to the exhaust from the engine, and is equipped with



One man prepayment motor bus, typical of a number giving satisfactory service in Cleveland and other U. S. cities. Entrance and exit by same door. Seating capacity twenty-six.

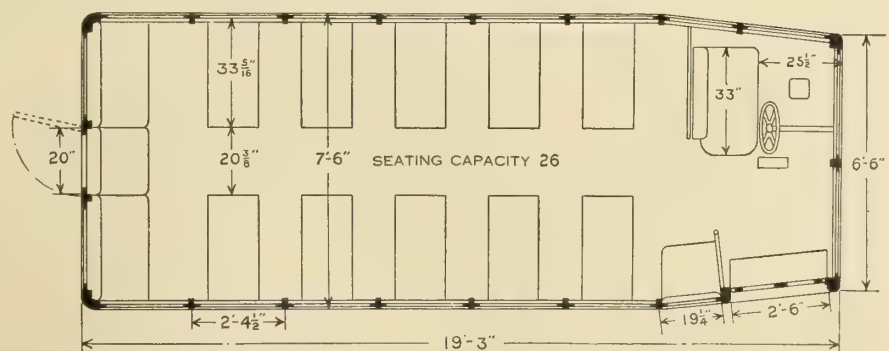
It is the intention of the railway company to operate these buses as feeders to the railway system in outlying districts and in suburbs which have not developed to the extent which warrants railway extension. It is expected that this enlargement of transportation facilities will stimulate the growth and development of the suburbs to the advantage of both the city and the railway system.

The buses illustrated are designed for one-man prepayment operation, the entrance and exit of passengers at the

valves with which the exhaust may be transferred to the muffler in warm weather. Ventilation is obtained through two ventilators located on the top panel on each side of bus.

In the underframe, the construction may be called composite; the side sills,  $2\frac{1}{4}$  by  $4\frac{5}{16}$  in., rear-end sills  $2\frac{3}{4}$  by  $5\frac{5}{8}$  in., and cross member fillers  $1\frac{3}{8}$  by  $1\frac{13}{16}$  in., are of oak, while the crossings consist of seven 3-in. 4-lb. channels with oak fillers, mentioned above, to which the flooring is laid. Ash is the material used in the upper framing, the

Plan of Cleveland omnibus—These cars are proving their worth in well settled sections where street car service is poor, as auxiliaries to the regular lines.



forward right-hand corner of the body permitting the driver to collect the fares and control the operation of the simultaneously-acting folding doors and lower step from his position on the left side. All sashes are of the double type, the upper half being stationary and the lower arranged to

corner posts being  $3\frac{1}{2}$  in. thick, and the side posts  $1\frac{3}{8}$  in. thick. The exterior sheathing is poplar. The three-ton White chassis on which these buses are mounted is of a special design, and is equipped with the Westinghouse air spring shock absorbers both at the front and rear.



# Tramway Labor Conditions in Europe

## Wages Lower, Rates Higher and Transportation Facilities Inferior to our Own—Report on a Number of Continental Cities

At the annual convention of the American Federation of Labor in Philadelphia last week there was a special report entitled "Labor Conditions on European Municipally Owned Railroads," presented by W. D. Mahon and L. D. Bland, who visited Europe this last summer in accordance with the following resolution adopted last year at the Seattle convention of the federation.

"Whereas, the question of municipal ownership and operation of street and electric railways is being considered by a number of the municipalities throughout the United States; and

"Whereas, this is an important question to the thousands of organized workers in the various trades and callings that follow this line of employment; therefore, be it

"Resolved, That the president and executive council of this American Federation of Labor are hereby instructed to make a thorough investigation as to the wages and hours of labor and the conditions of employment, including the rights of the employees to collective bargaining and the protecting of their labor through organization in such countries as have already adopted and are now operating their street and electric railways under municipal ownership, the results of this investigation to be submitted to the next convention of this federation with recommendation thereon."

An abstract of the report as given in the Electric Railway Journal is printed below:

### Germany

Of the 209 tramway systems in Germany, 134 are in the hands of private companies while the other seventy-five are owned and operated by local administrative bodies, districts or municipal councils. In some cases there is joint ownership by the municipalities and private parties, and there is a tendency to place the operation of these jointly owned properties in the hands of private parties to avoid the responsibility of operation and of dealing with the labor question.

Organizing the street railway workers of Germany has proceeded with great difficulty and under trying circumstances. It is claimed by some that the tramway employees have no legal right to organization. Old age, sickness and accident insurance are compulsory by law. According to Mr. Rathmann, the tramway representative of the Transportation Workers in Berlin, "A sudden rush to join the organization as soon as it is worth while, that is, to secure an increase in wage, and quite as sudden a rush to leave it as soon as the movement is over, seems to be a peculiarity of the tramway men, which in spite of all educative efforts of our union we have not been able to exterminate up to the present."

The report adds that although the German union, during the past three years, has fought on behalf of no less than 36,631 employees for an increase of wages, the records for 1912 show that among all these numbers there were but 8,528 in good standing in the organization. The strikes of German tramway employees have been of short duration, the longest on record being three weeks. This occurred in Königsberg in 1912.

Under the head of "working conditions" the report says that the organized workers of Germany have no general labor contracts as in the United States. All contracts are made by the individual worker with his employer. He makes a contract to cover his probation period, then after he is accepted as a regular man, he makes another contract. Except as the

organization has been successful in modifying them, the contracts are severe in their demands, restrictions and penalties.

The following are some of the working conditions of German tramway employees, according to the report, except that the money is translated into American currency:

"A man going to work on the trams must practice for eight weeks to learn the business. This is a government regulation. For that work he gets 60 cents a week. He must also put up an indemnity in the way of a forfeiture, averaging about \$18, and this stands against him, indemnifying the company in cases of breakage or any violation of the company's rules and regulations, for all concerns have a system of fines ranging anywhere from 24 cents to as high as \$3.60 or \$3.84, which are imposed for the violation of rules and regulations. So if a man should fail to report in the morning and lose his run he would be fined from 24 cents to 48 cents for such offence.

"The medical test in the tramway service throughout Germany is very rigid. In addition to answering satisfactory specific questions pertaining to military service, an applicant must undergo a thorough examination by the officiating doctor and be pronounced physically sound.

"The company reserves the right to discharge without notice, while the employee who desires to quit is required to give notice in some instances as long as three months in advance. Failure to comply with this regulation invariably results in forfeiture of bond, and, as one of our German brothers put it, 'every strike is a breach of contract and if the men lose they forfeit their bond money.'

"An example of this is shown in the report on the strike of the tramway men of Saarbrücken, which occurred in 1911. It was conducted by a union not affiliated with the regular movement. The strike failed, and every striker reinstated had to pay the company 50 marks (\$12) from his deposit money. The security was then increased 50 marks, so that each had to put up another 50 marks to make the deposit 100 marks (\$24). The men who refused to return to work were fined by the company 92.50 marks, which practically confiscated the amount they had on deposit.

"All concerns furnish uniforms for the men, but these uniforms are furnished just as a shovel or any other tool is furnished. They are not the property of the men at all. They are simply worn while in the service, are kept in repair, and when the men leave the service they must be turned back to the company, or else they must be paid for out of the indemnity which the employee deposits on entering the service."

The report, in comparing the wages in 192 German cities, on both municipally and privately owned systems, says that the average wage for motormen during the first ten years of service varies from 73.5 marks (\$17.64) to 147 marks (\$35.28) per month. During the first five years of employment there are fifty-six concerns that pay from 73 to 90 marks (\$17.25 to \$21.00) and 124 that pay from 90 to 105 marks (\$21.60 to \$25.20). Some of the wage scales call for fifteen, twenty and thirty years of service and even more before the maximum pay is reached. The conductors usually get about \$3 a month less than the motormen. This difference they are supposed to make up in tips they receive from the riding public.

### France

There is no municipal tramway department in France. In Paris there are some 24,000 men employed in the tram-



way, underground and omnibus systems; 10,000 on the trams or surface railways, 5,000 on the underground, and 9,000 on the omnibus service. Of these the tramway and underground men have responded least to organization.

The systems of wage on the transportation lines of Paris differ. Some employees are paid by the month, some by the day, and others by the hour. In the train service there are five grades of pay. In the fifth class men receive 165 francs (\$33) a month; fourth class, 175 francs (\$35) a month; third class, 185 francs (\$37) a month; second class, 195 francs (\$39) a month, and first class, 200 francs (\$40) a month. The entrance to these various classes is not fixed by time service, but depends upon vacancies in each, so that promotion from a lower to a higher class, with resultant increased pay, can come only when a vacancy occurs. The workday on the Paris trams is ten hours, and most of the runs are completed within twelve hours. The law provides one day off in seven.

#### Switzerland

There are forty-one tramway systems in Switzerland, eight of which are operated by municipalities and thirty-three by private concerns. The total number of all tram employees in Switzerland is 3,553, including all classes. The right of the workers to organize is guaranteed by law. The laws of Switzerland also provide for insurance against sickness and accident. The managements are compelled to insure all employees and pay all premiums.

The wage at Berne for conductors starts at 150 francs a month, or \$30, and reaches 220 francs a month, or \$44, in ten years. The beginning wage for motor men is 155 francs a month, or \$31, and after ten years the maximum is 230 francs, or \$46 a month. The workday is nine to ten hours, completed in fourteen to fifteen hours. Berne has a municipal line. On the privately operated trams in Switzerland, the wage paid employees is a trifle less than on the municipal roads.

#### Italy

The investigation of the conditions in Italy was interrupted by the outbreak of the war. Some figures, however, were obtained in Rome and Milan. In Rome there are one steam and four electric lines. One of these is owned by the municipality, which will take them all over in 1920. The wages on the private lines begin at 64 cents a day, and the maximum wage after ten years' service is 94 cents a day. The workday is nine hours, completed in about thirteen hours.

The wage on the municipal road is 10 cents a day more than on the privately owned roads, but other conditions are about the same. On the municipal system the employees are paid every two weeks, and on the private systems they are paid every week. Trainmen on all roads have one free day in every fifteen.

#### Great Britain

Two cities only in Great Britain were investigated, London and Glasgow. The wages for the motormen and conductors on the lines of the London County Council Tramways are from \$1.20 to \$1.60 day. These wages are higher than on the privately owned lines in or about London, but the latter are all outside the County area and in less congested districts. The workday is nine to ten hours, completed in fifteen, and the six-day week prevails.

In Glasgow the employees in the various mechanical departments of the municipal tramways to the number of about 400 are organized, but the motormen and conductors, who number 3,012, have no union. One was organized in 1911, but disbanded after a strike. The men work a six-day week of fifty-one hours. The wages per week for motormen and conductors vary from \$6.48 for the first year to \$8.16 for the seventh year and \$8.40 thereafter. The physical tests required are very rigid and more exacting than for military service.

#### Conclusions

The conclusions in full follow:

"We began our investigation of conditions surrounding the tramway workers of Europe with an open mind. We were ready for impressions and determined to report facts as we found them. The war prevented us from going into the investigation as thoroughly as we had planned, yet the field that we covered and the access we had to information gave us a good understanding of conditions.

"The tram systems of Europe are not to be compared to the street railway systems of the United States. Throughout continental Europe and the United Kingdom, in the most thickly populated centres, the street railway service is inferior to ours in many respects. In the continental cities the track mileage is small compared with the United States. This contributes to density of traffic and profitable operation. The same is true of the United Kingdom, whose total street railway trackage is about 3,600 miles as against 40,470 miles operated in the United States.

"We found the same spirit of commercialism dominating the electric railway systems of Europe, private and municipal, as exists in this country. If any credit is to be given either, it belongs, in our opinion, on this side of the water, for the American system, to our minds, is not only cheaper to the public, all things considered, but the service is better with a great deal more of it. Cheap fares on the zone system prove dear fares to the worker if he has to ride any considerable distance or take intersecting lines, for each zone entered means an additional fare, and there are no transfers on European systems. Zone fares and inadequate wages force the workers of Europe to live close to the workshop, mill or factory. It is rare to find a European worker who can afford to live in suburb or country, miles away from his work, as is frequently the case here. The rate of fare for long distance makes it prohibitive, and the wage will not warrant the expenditure.

"Thus the zone fare system contributes to congestion and compels the workers to live in the most uninviting districts. It retards suburban development and adds to the rents of the workers, who not only have to suffer the inconvenience of small living quarters but are denied sunlight and sanitary surroundings as well.

"And right here we desire to comment that with all the claim for legislative enactments helpful to the workers, municipal utility enterprise and co-operative development, we found the living standards of the workers of Europe, tram as well as others, so far below the average of the workers of America that no comparison is possible. The rapidity with which the workers of Europe are grasping the truth that their efforts must be concentrated in the economic field, through their trade unions, was the most hopeful sign that this condition would be altered.

"None of the European systems has a night car service, such as we have in our big cities. Nor have they an inter-urban electric service, that has contributed so much to the development of our rural districts and brought the consumer and producer into close relationship.

"Nor can there be any comparison between the wage of the European tram employee and his brother in the United States. From the viewpoint of the purchasing power of a dollar it has been estimated by careful observers that the cost of living in various parts of the United States is 25 per cent. to 65 per cent. higher than it is in various parts of western Europe. The difference in the money wage of the street railway men of these countries is much greater. The highest wage paid any body of tramway workers in Europe is safely 100 per cent. less than the rate paid in this country in the same occupation, and we found this to be the fact both on private and municipal systems.

"Our investigation showed that wherever the tram workers of Europe enjoyed advanced wage and labor conditions



their trade unions were responsible for them. Where the trade unions are active there the best results obtain, and whether dealing with a municipality or a private company the employees have found it necessary to maintain their unions to establish and protect their conditions."

### Encourage Your Men

Encourage your men by expressing appreciation of the motormen and conductors who are habitually neat in their appearance and clean. The man who keeps his uniform properly mended, clean and pressed, all his buttons on, wears a clean shirt and collar, keeps his boots polished, and gives himself a daily shave, is not only a better representative of the company, but he feels better himself, does his work better, has more self-respect and demands more respect from all he comes in contact with. The effort needed is considerable, but may be formed into a habit. The extra expense of keeping one's uniform in good order is more than offset by the longer wear these uniforms will give. Encourage your men to be self-respecting. Employees who think well of themselves will think well of the company that employs them and this will go a long way towards regulating what the general public thinks.

### B. C. E. R. Social Club's "Annual"

The annual office staff banquet of the British Columbia Electric Railway given by the Social Club, was held this year at the Elysium Hotel, about 125 members being present. All the chief officials were in attendance, and most of them were heard from during the evening. Following the toast to the King the toast to Canada was proposed by Mr. G. Porter, assistant chief engineer, and was replied to by Mr. R. E. Glover, general executive assistant. The toast to the B. C. Electric Railway Company followed. Mr. A. E. Beck, claims agent, and Mr. G. R. G. Conway being the speakers. The toast to the Social Club was proposed in a very happy vein by Mr. George Kidd, general manager of the company, who in closing said he was greatly impressed by the really fine type of men who composed the office staff, and was pleased to be afforded an opportunity for mingling with them through the medium of the Social Club. In replying, the chairman, Mr. W. G. Murrin, general superintendent, outlined the good work of the Club in providing facilities for social enjoyment, amusement and education. It had been established two years ago through the generosity of the company, and now numbered 175 members, who during the winter would enjoy a program of lectures, dances, smokers, tournaments, social gatherings, etc. The closing toast to "Our men at the Front," was proposed in eloquent style by Mr. Frank Harris, publicity agent, the response being three cheers and a "tiger" for the members who had volunteered at their country's call. During the evening vocal selections were contributed by the following members of the office staff: Messrs. J. R. Pacey, G. E. Watts, J. Jenkinson, R. Gray and M. F. Werth.

### Toronto By-laws

By-laws will be submitted in Toronto on January 4th, authorizing the expenditure of some \$600,000 in electric railway extensions. These consist of (1) construction of a civic car line on Lansdowne Avenue south from St. Clair; (2) a line to serve North Toronto passing through Mount Pleasant Cemetery; (3) the purchase of the tracks of the Toronto and York Radial Railway Company in the east, on which the franchise has expired; (4) to purchase motor-buses to the extent of \$100,000 to establish a service at certain needy points in the city.

### Constructing Power Plant

The Edmonton, Dunvegan and British Columbia Railway have under construction at the present time a power house to be equipped with some 250 kw. capacity in electric generators. This power house will be located at their terminal north of the G. T. P. railway track, Edmonton. The boiler equipment consists of two return tubular horizontal units, 150 h.p. each, working at 125 pounds pressure. Two generators of 125 kw. capacity each, direct connected, are expected to be in operation by the first of February, 1915. The output of the plant will be used to light their own terminal and also to operate the machinery in their car repair shop, which is also under construction at this point.

### Regina Municipal

The operation returns of the Regina Municipal Railway for the week ending November 21st, 1914, were as follows:—revenue, \$3,494.65; passengers carried, 81,243. For the week ending November 28th, the corresponding figures were \$3,087.35 and 75,464.

### Forest Hill Radial

Work has been started on the road-bed at Bathurst Street for the proposed Forest Hill Radial Railway. It is stated that the initial stage of the work on Eglington Avenue from Bathurst to Dufferin Street will be proceeded with as expeditiously as possible.

### Pay Regular Dividend

The Guelph Radial Railway Company, owned by the city of Guelph, recently declared the regular 5 per cent. dividend and in addition were able to pay all expenses and set some \$6,000 aside to credit of capital account.

### Toronto Municipal

The Council has passed a by-law authorizing the erection of a temporary car barn in connection with the line at present under construction on Bloor Street West.

A deputation recently waited on the Board of Control, asking that plans be considered for laying car lines south of St. Clair Avenue on both Lansdowne and Bathurst Streets.

Work is proceeding satisfactorily with the civic car line on Bloor Street west of Dundas. Commissioner Harris was recently given authority to purchase rolling stock, also land for car barn purposes, and to get the car barn under way at the earliest possible date.

### Tramway Situation in Montreal

Before the Montreal Board of Trade, Mr. Peter Witt, street railway commissioner for Cleveland, recently discussed the tramway situation as it exists in Montreal.

### Trade Inquiries

Name and address of inquirers may be obtained on application to the Electrical News, Toronto.

1197. **Railway ties.**—An Irish firm invites from Canadian manufacturers quotations, delivered Belfast, for 25,000 to 30,000 railway ties, made up of 9 ft. x 10-in. x 5-in., and also 6 ft. x 9-in. x 4½-in.

1166. **Dynamos, electric motors, electric supplies.**—Commission agent desires buying and selling agency in Argentine Republic for dynamos, electric motors and electric supplies of Canadian manufactures.



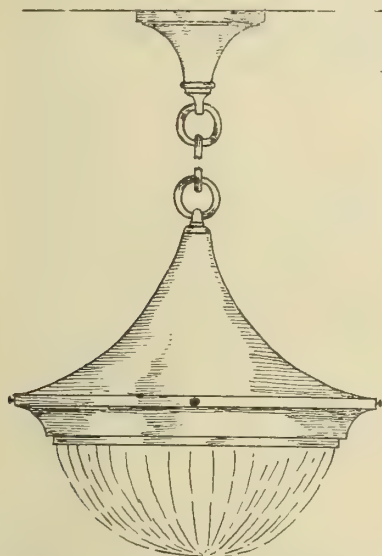
# Illumination

## The Illumination of Churches

**Good Lighting Contributes Largely to the Enjoyment and Impressive Effect of the Service**

The possibilities of correct illumination are splendidly exemplified in the photograph which we reproduce on the following page, of St. Simon's Church, Toronto. The illumination on the reading plane is practically uniform at every point and in every corner of the building. This photograph was taken at night, by the light of the regular illumination of the church. No flashlight or auxiliary illumination of any kind whatever was used. It is difficult to realize that so good an effect was possible, especially when the red brick walls are taken into consideration, these walls of course extending the full height of the side of the building.

No very special features are to be noted in connection with the wiring of this church. Below the ground floor all



Design of unit used in St. Simon's Church, Toronto.

work is in conduit, and above the ground floor everything is in armored cable. The switches and cutouts are installed in separate compartments of the same cabinet, each compartment having its own door and lock. The switches used are standard 10 ampere, Diamond H, indicating, rotary type; no knife switches are used. The cabinets are set flush with the panel work and finished to match. The meters in the basement are equipped with the Metropolitan Engineering Company's devices, which are being installed on all the larger services in Toronto, by the Toronto Electric Light Company, and the Hydro-electric System.

The proper illumination of this church, and especially the chancel part of it, was a fairly difficult matter. As will be noted in the photograph, the treatment of the choir section and sanctuary was chiefly with a view to bringing out the details and color effects of the decorations. St. Simon's has been recently re-decorated and is now one of the most beautiful and impressive places of worship in the city.

In the sanctuary, where, as shown in the photograph, there is an arched ceiling, handsomely decorated, cove lighting was resorted to. The treatment gives ample illumination for this part of the chancel and at the same time brings out very distinctly the soft, artistic blending of colors on both the walls and the ceiling. Sunbeam tubular lamps equipped with Canadian General Electric special reflectors were found best suited to give the desired results.

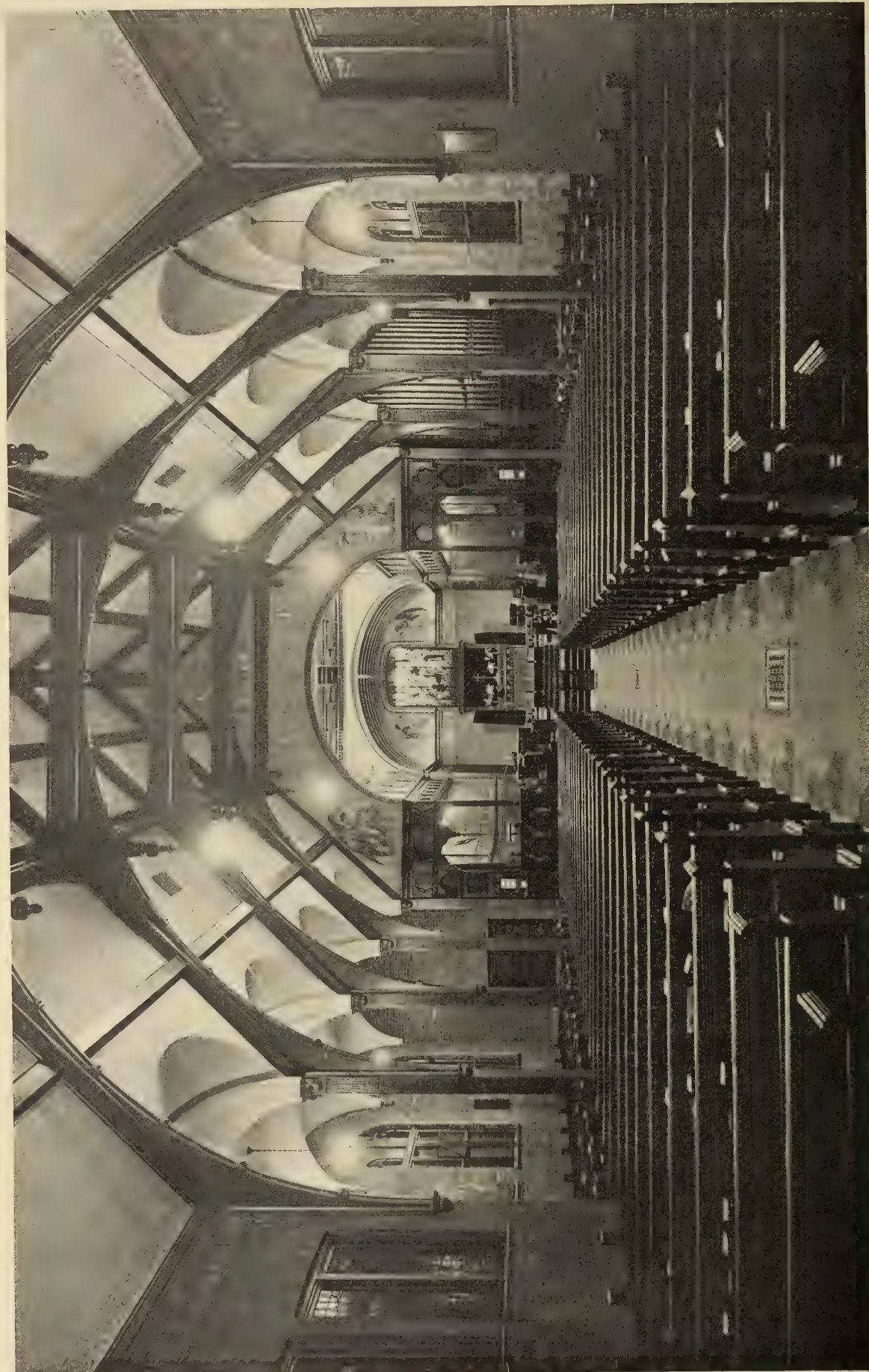
The choir part of the chancel is separated at the ceiling from the nave of the church by a heavy arch, which made the illumination of the decorations of the choir ceiling and walls very difficult. After much experimentation excellent results were obtained by the installation of eight 100-watt tungsten units (four on each side) enclosed in X-ray silver-lined reflectors. These are placed well up in the corner and are only visible from the chancel. The general illumination of this part of the church as seen in the photograph shows how well these units are doing their work.

Another specially interesting part of this excellent installation is the illumination of the plate glass window. Two 750-watt tungstens, enclosed in one of the new types of reflector manufactured by the Benjamin Electric Company, cause the different figures to stand out prominently and reproduce the colors in a very accurate and striking way. By this installation one of the chief beauties of the decoration of this church and which, under ordinary circumstances, appears to good advantage only in brightest daylight, has now also become a most attractive feature of the evening service. The effect of this window at night is now equally as beautiful and impressive as in bright sunlight.

The illumination of the main body of the church was rendered more difficult on account of its great height, as well as of the dark finish of the beams and ceiling. The type of unit finally chosen is that illustrated herewith, which consists of an enclosed semi-indirect semi-decorative type, suspended from the newels which project beneath the ceiling arches. In a total length of 85 feet, there are two rows of four of these units, each containing a 250-watt tungsten. In the transepts, which extend 12 ft. 3 inches to the right and left, and are 47 feet 6 inches long, eight units of the same design are installed, four on each side, each containing a 150-watt lamp. In the choir alcoves, which recede to a distance of 5 feet 6 inches to the right and left of the chancel, two units on each side containing 100-watt lamps are used. The total width of the church is 61 feet, and the illumination on the reading plane with the lamps approximately 22 feet from the floor is in the neighborhood of 2.5 foot candles.

The lighting units for this installation were supplied by the Colonial Fixtures, Limited, 424 Adelaide Street West, Toronto. The installation throughout was made by Mr. Thos. Jackson, electrical contractor, 11 Sorauren Avenue, Toronto. Congratulations are certainly due the electrical contractor for the splendid results obtained under general conditions which were none too favorable, and in spite of certain special conditions which were absolutely novel and well-nigh impossible to overcome.





Example of almost ideal results in church lighting—Photograph taken at night without any auxiliary lights whatever.



# Good Street Lighting in Outremont, P.Q.

**First Canadian Municipality to Have all Lights Served by Underground—500, 6.6 Amp. Nitrogen Lamps on 20 Miles of Street—Specially Designed Fixtures**

On December 1 the town of Outremont, P.Q., inaugurated a new street lighting system—being the first city or town in Canada to have all its street lighting system served by underground cables, and also the first city or town to adopt nitrogen-filled tungsten incandescent lamps. Madame Beau-bien, wife of the Mayor, pressed the button which put the system into operation. The power is supplied by the Montreal Light, Heat & Power Company, in bulk, at the border of the town on St. Viateur Avenue over duplicate feeder circuits. From this point the power is transmitted to a centrally located town substation, adjacent to the Fire and Police Stations, by duplicate underground cables, installed by the town in the municipal conduits. At the sub-station is located the meter equipment and the constant current regulators with switchboards, which transform the power received, for the supply of 6.6 ampere constant current street lighting circuits throughout the town.

The town is at present wired for ten separate circuits supplied from five regulators, and one extra regulator installed is held as a spare for emergency use. The two lighting circuits supplied by each regulator are in every case arranged to serve widely separate districts in the town so that damage to a regulator would affect two small areas at different parts of the town and not plunge a large area into darkness.

All circuits to the lamps are carried underground; approximately four miles of cable are installed in the municipi-

Provision has been made for extension to this system and all plans are prepared for the addition of four more circuits. The complete system anticipates the installation of 400 more lamps, bringing the total to nearly 900. This extension can be economically made when conditions justify the expenditure. The lamps at present used are of two sizes, a 400-candle power lamp on the streets where there are tramway



Combination trolley and lamp post.

routes and a 250 candle power lamp on all other streets.

The lamp posts are bracket posts, artistically designed specially for this installation and are placed on the boulevard side of the sidewalks so as to reduce all obstruction on the sidewalks. This places the lamp over the centre of the sidewalk. On tramway routes a combination pole is used to allow of the attachment of the tramway trolley span wires. The lamp standards are spaced 200 feet apart on one side of the street, but where there are tramway routes the spacing is 200 feet on both sides of the street.

All cables, lamp posts, lamps, regulators and switchboards are of Canadian manufacture, the total cost of the installation, including the sub-station building, being about \$75,000. The installation was made under the direct supervision of the town engineer, Mr. Duchastel. The consulting engineer was L. A. Herdt, D.Sc., of Montreal, assisted by Mr. E. G. Burr.

The standards were supplied by the William Hamilton Company, Peterborough, Ont.; glassware by A. H. Winter Joyner, Toronto; lead covered and armoured cable by the Eugene F. Phillips Electrical Works, Limited, Montreal; 6,600 volt rubber covered cable for the standards, and the nitrogen filled incandescent lamps by the Northern Electric Company, Montreal; 6-panel switchboards for regulators and two main panel boards for two underground incoming lines, by the Canadian General Electric Company, Toronto. Mr. G. M. Gest, Montreal, had the contract for laying the conduits.

Residents at Creston and other Kootenay points now enjoy telephone communication with Spokane, Wash., and intermediate points, the Creston line having recently been connected up with the Pacific States Telephone Company at Porthill, on the boundary.



Lamp directly over centre of sidewalk when laid.

pal conduit for this purpose, and the remainder is steel tape armored cable laid directly in the ground. 14,000 feet is of twin conductor No. 8 B & S steel tape armored cable, and 90,000 feet of single conductor No. 8 B & S steel tape armored cable. The cable runs out on one street and returns on another. The total number of lamps now installed is 498 and approximately twenty miles of street is illuminated.



# The Dealer and Contractor

## Your Christmas Window Display

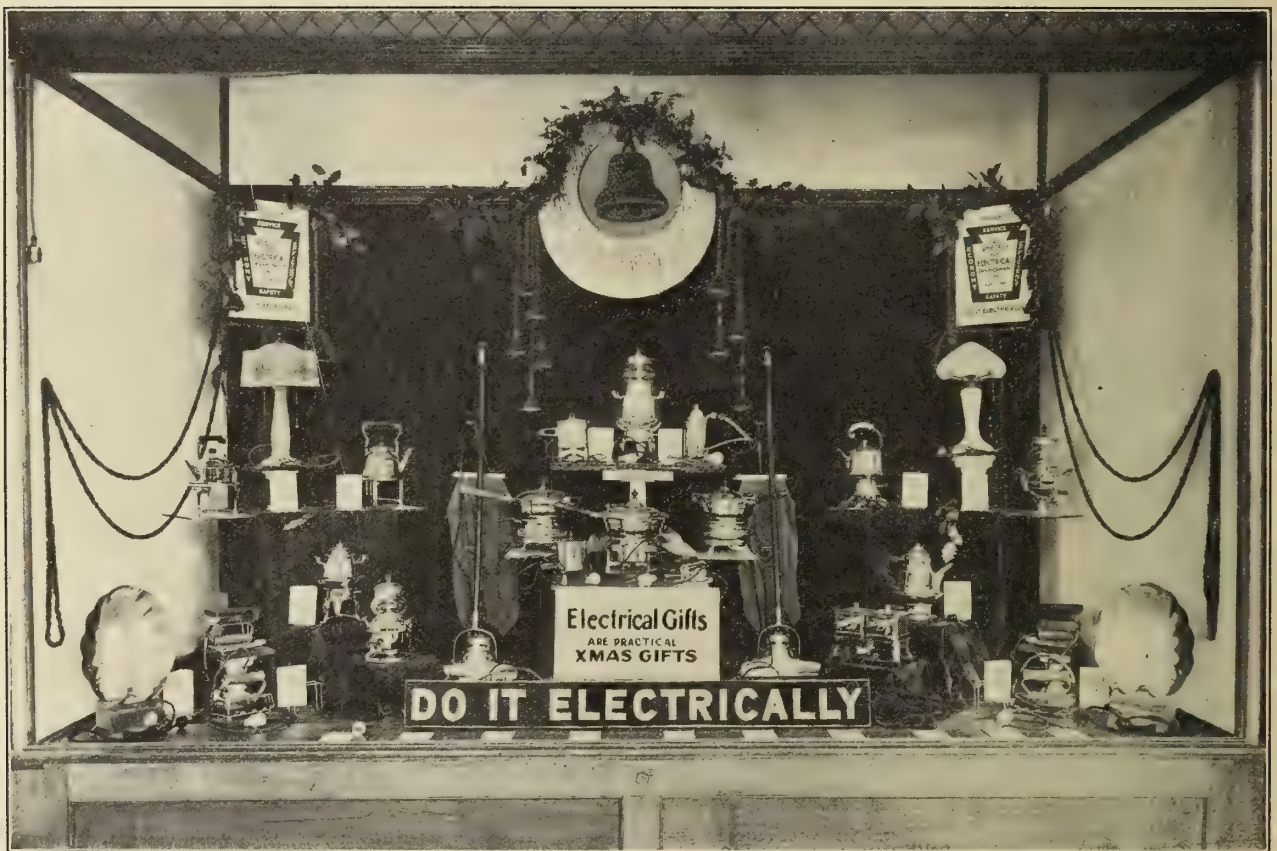
**Attractive Window Spells Prosperity—A Salesman  
That Works for You Day and Night—  
Suggestions for Decorations**

During twelve months in the year, the show window is the best sales producer that is to be had. In December it should be at its very best for it is during the Christmas shopping season, even more than ever, that people look to show window displays for suggestions.

The display that is commonplace will attract only casual

At night his show window is bright and sparkling and he smiles with pleasure when he sees his competitor's store front dark. He knows that during the evening his good and faithful employee (his show-window) will be on the job making sales for the morrow.

He realizes that people are most susceptible to impressions during the evening hours and he feels that his show-window is a worthy representative of the business. And surely the show-window, the whole store front, is the representative of the business that most people know. The public frequently judges a store from the appearance of the front, and this fact alone would make it worth while keep-



Wherever the attractive window is, there will be found a prosperous merchant.

observation, and makes the neighboring window, that is attractively made up, appear even better by comparison, a great number of window displays acting only in the capacity of settings for the jewel that is found here and there.

Wherever the attractive window is, there will be found a prosperous merchant who is getting much of his prosperity from his tireless twenty-four-hour salesman, from the sales made from the show-window. He appreciates the results his displays get and keeps its appearance up to a high standard.

By A. J. Edgell, of the Society for Electrical Development.

ing the show-windows attractive.

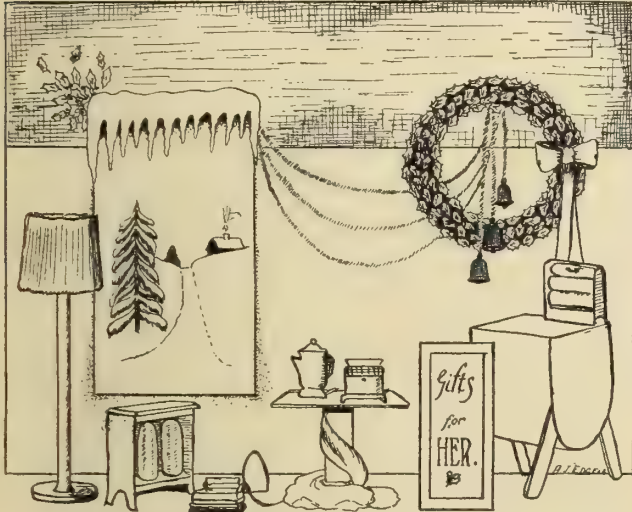
It is not difficult to arrange displays that will sell merchandise and add to store prestige. With a few pedestals and glass-shelves and some judgment, a fair display can be made by anyone. Care should be taken that the display does not have a "flat" appearance.

The accompanying photo and sketch are suggestions for displays of devices for Christmas gifts. The Christmas season gives an opportunity to introduce many electric appliances to the public, because they are especially suitable for



Christmas gifts of the useful, practical kind.

The photograph illustrates an attractive setting and arrangement for a general Christmas display of devices. The decorative accessories are in the bright holiday colors, red and green. The main background feature consists of a cardboard circle with a large bell in the opening. Over the circle, sprays of artificial holly are attractively arranged. From either side of the circle, pendants of chenille roping or tinsel with small bells are hung. The merchandise is grouped in "units" on the fixtures shown in the small photograph. The fixtures consist of pedestals, glass shelves and wooden boxes. Over them is draped velours of dark green. An electric sign reading "Do It Electrically" and card with the inscription "Electrical Gifts are Practical Gifts" are shown in the fore-



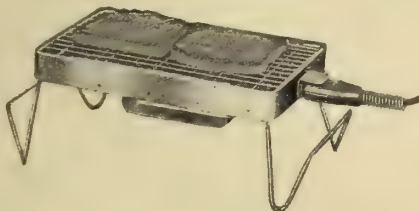
Sketch suggestion for "Gifts for Her."

ground. Descriptive booklets are used to link the display with the advertising literature sent out by the dealer.

The sketch shows an arrangement for a display of "Gifts for Her." A window of this type is an especially good sales-producer as it gives an opportunity to show gifts suitable for "Her" ranging from those for the Baby to those for Grandma. A similar "Gifts for Him" display could also be made. A large wreath made from artificial or real holly or laurel is attached to the background. A large red bow of ribbon or crepe-paper embellishes the wreath. A panel with a winter scene, obtained from a sign-writer has a few sprays of artificial holly attached.

### Combined Broiler, Stove and Toaster

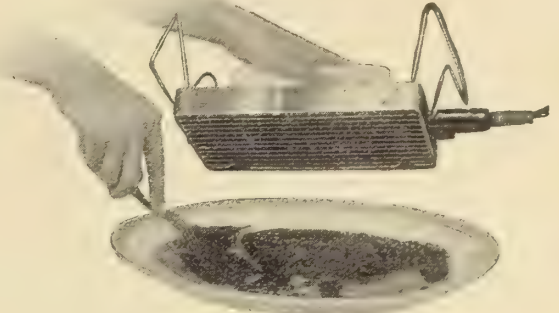
An extremely simple, useful and practical electrical device which can be used as a broiler, stove and toaster has just been put on the market by the Canadian General Electric Company. The 1915 Electrical Household Utility, as it is called, has a cooking area  $5\frac{3}{4}$  inches by 9 inches, weighs



A practical combination.

only  $1\frac{3}{4}$  lbs. and can be connected to any convenient electric receptacle. In order to broil you simply invert the grill and place it on the meat which rests on the serving plate or platter. The meat is cooked tender under ideal conditions as there is no flame or combustion. All the juicy tenderness of the meat is retained, as it is quickly seared,

while the juices are collected in the platter which is kept warm by the heat from the device. It "saves the gravy." This Utility Grill toasts equally as well as any toaster and



Raise the grill and turn the steak.

can be adapted to all purposes for which a stove is used. Ordinary cooking utensils are used and at the average price for electricity it costs only half-a-cent for 15 minutes' use.

### A Mountain of Old Irons

The Victoria Branch of the B. C. Electric Railway Company, Limited, Light and Power Department, held an iron sales campaign recently, covering one month. One feature of the campaign was the acceptance of old irons in part payment of the purchase price of a new iron, fifty cents being the allowance made. The result is that 222 brand new



These all exchanged for "Electrics."

irons are now on the company's lines, in place of the miserable-looking outfit reproduced in the picture herewith.

Apart from the fact that the company's monthly earnings will no doubt be touched up a little, the officials feel that they may have done a few humane acts in bringing in the old irons, particularly a few old gasoline ones. It is estimated that well over 90 per cent. of the company's lighting consumers are now using the handy electric iron.

C. H. Mitchell, consulting engineer of the Water Power Branch, Department of the Interior, Ottawa, during the past summer prepared plans for a hydro-electrical installation at Banff, in the Rockies, at the solicitation of the Canadian Pacific Railway Company. The work will likely be proceeded with during the winter.

**DO IT ELECTRICALLY**



# The Central Station-Contractor Problem

## View-point of a Contractor Engineer—Field of the Central Station Defined—Contracting Soon a Profession

The story of the Central Station is a history of electric lighting in this country together with the enormous kindred business interests which have been created as a result of these operations. It is not necessary for the purpose of this article to enter into a review of this history.

We may, however, with interest and possibly some degree of profit to ourselves look into the factors which were responsible for the creation of such an epoch-making industry, and decide if we may safely deduce conclusions which applied to our daily business life may offer a solution of these problems, which solved will reward with a profit instead of a loss, the operations of many an electrical contractor.

A large number of the more important of the Central Stations in operation to-day owe their existence and support in the earlier struggles which preceded their present power and influence in the electrical field to the policy of the company which was formed to manufacture the Edison lamp and dynamo, newly placed in the market, and to develop commercially the electric lighting industry. To this end lighting companies and plants were established in various parts of the country and financial support furnished, in return for which the lighting company made a close working agreement with the manufacturing company covering the use and sale of their patented apparatus, lamps, and other supplies. These plants were known and are familiarly styled, even to-day, as Edison, or Licensee Plants.

The undeveloped condition of the country, electrically, at this early period and the intimate relationship between the parent company and the Edison plant, or Central Station, as it soon came to be called, coupled with the active support and dominant business policy which the company consistently dictated to these Edison Plants, resulted, not only in a rapid development of the business, but a well-defined plan or business policy on the part of these plants toward the public.

To-day, scarcely thirty-five years since the inception of this enormous industry, we find this influence still dominant, either directly or by inherited policy, in the operations of many of our Central Stations. Changed, to be sure, but rather because of the great development of the industry and an increased technical knowledge than by any desire to alter a policy which had been handed down for more than a generation and which had been so signally successful.

### No Contractors Existed Then

The electrical contractor was not a factor at this early period because his work as a business did not exist. The Companies were the entire electrical industry within themselves. For they built, in a sense, the apparatus and machinery, erected and operated the lighting plant, constructed their lines, and finally, installed the wiring on the premises and supplied the lamps.

The customer paid for the current. Everything else was done for him by the Central Station.

This condition was unique and not duplicated by any other business of the period. In fact to-day among the country's varied industries, there is no other line of business which in its attitude toward the community and other business interests quite parallels the operations of the modern Central Station.

After a time the great expansion, increase in competition, and the consequent necessity for greater economies suggested a separation of the inside construction or wiring end of the business, from the other operations of the plant, and

brought the electric wireman or contractor before the public in the industrial life of the community. Of this rapid rise in this branch of the business and the position he has come to occupy in the great electrical development of our busy life, it is not necessary to speak.

I would ask you to note the reasons, however, which led to the creation of his business. To my knowledge, and much though he may be criticized by the Central Station for his occupation of the portion of the electrical field which rightfully belongs to him, I do not recall a single successful challenge of the statement here made concerning the reasons for the setting apart of his work as a separate business.

### A Clear Field for Both

The complaints of the electrical contractor with reference to the operations of the Central Station are too well known to require extended repetition here. They might possibly be summed up in a few words by saying that he feels the business of the lighting plant should be chiefly confined to the generation and sale of current, leaving it to him to handle all inside wiring and the sale of supplies. His complaint to-day is that in greater or lesser degree the lighting companies themselves apparently desire to do most or all of these things. That while recognizing the electrical contractor and his business and inviting his co-operation, they seemingly ignore it by tearing down and making it impossible for him to exist. They readily admit the desirability of having the contractor's good will the more successfully to entrench themselves in the good opinion of the public and to keep out demoralizing competition. At the same time the company appears willing to be a party to the destruction of the contractor's business by the sale of apparatus and supplies which of itself profits them nothing, but which is to the contractor a desirable and usually profitable item in his business.

On the other hand and to some degree in defense of their acknowledged attitude of at least partial competition, the Central Stations claim they have been compelled to exploit certain lines in their show rooms since the electrical contractor failed to measure up to the requirements of modern merchandising. The point was made that he was in reality a workman, a mechanic if you please, and not a merchant.

In support of this it was pointed out that he had no adequate stock; that he employed no salesmen in the real sense; and finally, that his place of business partook on the average more of the nature of a warehouse than a modern store. Since under these conditions manifestly he could not properly display and sell these many new modern devices, the Central Station with their large show rooms and sales force were necessarily obliged to do so, else the logical growth and development of their business would be thereby impaired.

### Conditions are Changed

We are all familiar with this argument and are bound to admit that a few years ago it was substantially true. Recognizing this, and without attempting to argue the matter as to whether in spite of this admitted shortcoming, it was good business for the Lighting Company to openly antagonize him, the Contractor promptly set about the removal of this objection. Attention was drawn to this criticism on the part of the Central Station. Photographs of many attractive electrical shops were shown and suggestions offered for increas-



ing the attractiveness of these stores from a retail standpoint. Whether or not this campaign was the direct cause, the fact remains that there are to-day hundreds of electrical stores all over the country which in variety of stock and attractiveness of display compare favorably with the best stores in other lines in our cities.

The rapid increase in the number of these modern electrical establishments is not only noteworthy in itself, but especially interesting as showing the immediate response of the electrical contractor to this criticism of the Central Station. It furnishes a correct gauge of his feelings and is a proper index of his willingness, while asking a proper alignment of his business with that of the Central Station, to in turn meet a legitimate criticism more than half way.

And yet it would seem notwithstanding all the effort he had made to work out a satisfactory agreement with the Central Station it comes down to the same proposition in the end and the friction and antagonism remain.

Various attempts have been made to remove this disturbing factor and create a spirit of peace and harmony among all electrical interests. Many suggestions have been made. Plans have been formulated and a spirit of harmony engendered and put into operation. Nevertheless the spectre will not down. The problem is still before us, and is yet to find an answer either final or satisfactory to all interests.

#### Value of Combined Effort

Recognizing the pulling power and the force of combined effort towards a common end there have been many efforts made to unite the several lines of electrical interests on common ground.

The Co-operative Electrical Development Society is one of the more recent and important of these combinations.

The solution of this problem we are discussing is one the society hopes to help solve. The contractor has been told he should unite in this great movement, one of the more important reasons among others being that thereby is it hoped to bring him into a closer relationship with the Central Station and in a sense help to solve this problem automatically.

While this movement is still comparatively new and while progress is being made there appears to be a feeling of unrest and dissatisfaction among the contractor members and others regarding the real attitude of the Society toward this matter and a feeling of doubt of its ability to accomplish any real good.

The belief of the Central Station engendered of its earlier necessities and successes, and to-day everywhere manifest in its business policy, that it should dictate the policies of the electrical business community even as it dominates them, is now as it has always been, the crux of the entire problem. Studied in the light of present day business combinations and the birth and history of these great modern businesses and carefully considering all the solutions that have been offered, we are bound to conclude that nothing short of an abandonment of its traditional policy will bring about peace and harmony with this new and recognized business which the operation and working out of their own plans brought about.

#### Working in Harmony

I am entirely aware in suggesting this thought that many harmony plans are being wrought and even carried out, seemingly with success. Contractors and Central Stations in many communities are working in apparent harmony with good results to both.

I have myself taken part and helped bring about such arrangements. That they are not more uniformly adopted however is because even where seemingly most successful they are broken up over night by changes in ownership or by the modern business policy governing the operation of

public utility plants. I refer to the joint control of large numbers of plants by one holding company. There are a number of such syndicates operating in this country to-day.

Recently the manager of one of these controlled plants where a very satisfactory harmony plan had been worked out suddenly broke away and began cutting under prices on a certain line of supplies. When approached he expressed the greatest regret but explained he had received instructions from headquarters that his sales of this line of supplies were below the average set for his plant and he must therefore immediately set about remedying this condition. As a result he went back to the old cut price basis.

#### Cannot Fight Capital

Consider here for a moment the enormous capitalization of many of these plants. Many run up into millions—some in double figures in the millions' column.

Consider further what the combination of a number of such plants means industrially and ponder the feeble means at the disposal of the contractor to combat an adverse policy on the part of such a competitor. Experience has shown that the failure of practically all plans to date has been due directly or indirectly to these policies which the histories of Central Stations have made traditional coupled with the enormous and rapidly increasing capitalization and consequent combination of interests.

What then is there further for the Contractor to do? Where shall be found the answer to a proposition so complex? Shall we longer look for the solution in a co-operation which operates along rigidly fixed and apparently immutable lines? Shall we hope for an individual local solution when the local community, controlled from abroad, has lost its identity?

And yet, in this very local community perhaps shall we find the answer we seek. I have spoken of civic pride and the good of your fellow man. A man who is not stirred by a feeling of interest in his community, who will not give his time freely for its uplift and advancement not only adds nothing to the industrial worth but is a tax on the industrial life and a burden to the citizens.

#### Price-cutter Condemned

The price-cutter, my friends, comes under this head. He is not merely a vendor of cheap wares but one who strikes at the very heart of successful merchandising. If he injured no one but himself, mention of him here might have been omitted. The losses he causes a legitimate competitor to undergo, by depriving him of the just profit due his industry is taken out of the community and not added to its resources. Too frequently this man demoralizes the trade of his competitors if not his own, and causes loss to others through failures which in turn become a burden to be borne by the community.

He is an economic loss and a failure. Between such a man as this and a price cutting and trade demoralizing Central Station there is little, if any, distinction to be made. Necessity does not demand such a business policy and common sense and the public good forbid it.

May we not then, with confidence, appeal to that public with whom we daily and so intimately associate, to the end that this serious menace to her ultimate commercial success may be removed?

The power of public opinion no man, and certainly no corporation shall successfully withstand. If the fundamental and principal business of a lighting company is the furnishing of current at reasonable rates shall we not best do our duty as citizens and at the same time legitimately serve our business interests by requiring that these companies confine their energies to this and this alone?

If the spirit of the people is to-day strongly adverse to monopoly and the consequent crushing of legitimate enter-



prise and competition will not this operate to make the task correspondingly easier? If it be true that this encroachment by the Central Station on another business already in successful operation, causes an increased expense for current which must necessarily be added to the customer's bill, would not the community profit industrially in much greater degree if the lighting company dropped these side lines, and gave to the community the lower rates which this concentration would make possible?

So to-day, and granting these premises, the truth of which experience has suggested to us, may we not face seriously the proposition of seeking through an aroused public sentiment, the passage of legal measures which shall forever divorce the well defined business of the Central Station from that of the electrical contractor? No intelligent enlightenment of the public concerning many of the operations of the Central Station has ever been seriously attempted by the contractor. I do not for a moment doubt the effect of such a movement. We have all learned that the victories of peace, especially in a business life are to be highly desired and are therefore profitable, but there comes a time when ambition is stultified and progress is arrested by too readily yielding to her allurements.

#### **The Spirit is Willing**

Nor would I leave with you the thought that the plan here suggested is merely destructive in character. The broad-gauged attitude of a great many Central Station managers and their very generous support of many of the contractor's plans is too well known to require comment here. It is a fact, however, that some of these very managers operating syndicate plants have themselves suggested that they would welcome such action as would permanently define the policy of their company towards the contractors and leave them unhampered in the working out of their harmony plans in the local field. At present their hands are tied, and the manager acting under definite instructions from the foreign office, is placed in the undesirable position of seemingly breaking faith with the electrical contractor and thereby upsetting plans and creating ill-feeling to the overcoming of which he had previously devoted many hours of hard work. Viewed from this standpoint such a plan as herein presented is in the end truly constructive in character and conducive to peace rather than aggressiveness.

Whether we have come face to face with this condition in the relations between the Central Station and the Contractor as set forth in this presentment and seen in this suggestion a solution of the problem is a matter which must be left to sober thought and calm judgment. If it is to be finally solved it must be approached with an open mind and a spirit of fairness, granting freely the rights of the Central Station and the great part they play in our industrial development while in turn we ask for the electrical contractor the portion that is his due, to the end that he may come into his own and take his proper place in the splendid electrical development which the close of this 20th Century shall have seen brought about.

#### **An Important Contract**

The contract for the wiring and for installing the electrical equipment of the new Customs warehouse, Ottawa, has been awarded to the Canada Electric Company, Montreal. The current for lighting and power purposes will be supplied from a sub-station at 2200 volts, and stepped down to 440 volts for power and 110-220 for lighting. The company will supply six transformers—3 of 60 kw. and 3 of 75 kw. The switchboard will be 27 feet long. Three elevators and the ventilating, pumping, and heating systems will be electrically operated, direct current being used for the elevators. The motors will be direct connected, and their supply is not included in the contract. All the telephone wires will be in conduit.

### **Eliminate the "So-Called" Contractor**

Toronto, December 9th, 1914.

The Editor,

Electrical News,

In your issue of December 1, you publish a letter which is being, or rather has been, sent out to the electrical interests in the Province of Ontario by the Hydro-electric Power Commission.

The writer, as an electrical contractor, appreciates very much the favorable comments that you have made on this proposed legislation.

One of the greatest difficulties that the reliable electrical contractor has to contend with is the competition from "so-called" electricians who may maintain an office under their hat—who install electrical work regardless of standard safe methods of construction and create hazards to life and property.

In my opinion legislation along the lines suggested in the letter will be good—will eliminate the so-called contractor who is here to-day and gone to-morrow, and who has no responsibility to the public.

It is perhaps unnecessary to state these facts—everyone familiar with the business is aware of the unsatisfactory conditions—and every one interested will help to remedy the same.

The Electrical Contractors' Association of Toronto is taking this matter up and would be glad to have opinions from electrical contractors giving their ideas of the licensing system—the fees—and in fact any information that they may have regarding licensing systems in other cities.

Communications on this subject should be addressed to George J. Beattie, Secretary, Electrical Contractors' Association, 72 Victoria Street, Toronto, and be sent at once.

It is the intention to call a general meeting of all interested electrical dealers in the Province to take up this question—in the very near future.

Yours very truly,

George J. Beattie,

"The Electric Shop."

#### **Novel Sign for Brick Manufacturer**

The Farr Brick Company of Cleveland are firm believers in electrical advertising and recently searched for several weeks in an attempt to locate a suitable roof location on which to place an elaborate electric display. Not getting a prominent space, Mr. Mitchell, manager of the company, opened negotiations with parties owning a piece of vacant property and secured a lease for a number of years. With the aid of the chief designer of an electric sign company of that city, the idea was conceived of building an ornamental wall of brick to be capped with an electric sign. The advertising value of this structure was greatly enhanced by the air of mystery which surrounded the building operations, as nothing of the sort had been attempted before. When complete, the structure will be an ornament to the city, being built in colonial style with the Farr company's new face brick.

The advertising value of this structure has been increased by providing conveniences for the public. Stone benches have been placed and a sanitary drinking fountain, which is to be iced in the summer time. Boxwood trees in ornamental concrete vases beautify the corners and two flag poles 70 ft. in height surmount the corner columns. The electric sign placed at the top of the wall is said to be a marvellous work of art, representing the trade-mark of the company, a winged brick surrounded by an outline of clouds, under which the words, "By Farr the Best" stand out prominently. The wings have the appearance of flying while the clouds in the background seem to be driven by a high wind, preceding a storm.

It is understood that the entire construction cost of this



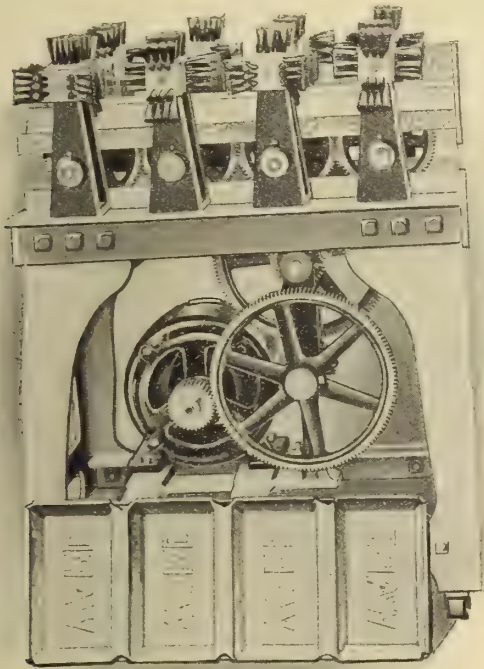
sign is approximately \$10,000. The wall is 85 ft. long and 30 ft. high, and the sign is 65 ft. by 30 ft., requiring 1200 10-watt mazda lamps, half of which are equipped with color shades which produce the natural colors desired.

#### Permanent Canadian Representative

The Morgan Crucible Company, Limited, London and New York, manufacturers of the well-known "Morganite" and "Battersea carbon" brushes, have now a permanent Canadian representative in the person of Mr. Neville G. Johnson. Mr. Johnson will have his headquarters in Toronto, where he will hold himself in readiness to give his personal attention, backed by engineering training and experience, to the interests of all users and manufacturers of electrical machinery at any point in Canada.

#### Electric Bread Pan Cleaning and Greasing Machine

The illustration below shows a rather unique motor application—a machine patented and manufactured by Gottschalk & Company, Reedsville, Pa., for cleaning and greasing bread pans. By means of a set of stiff brushes the pans are cleaned. Then the opposite set of soft brushes are used for greasing the pans. By cleaning the pans thoroughly before greasing them, the machine eliminates any spots on the



Bread Pan Cleanser and Greaser with Robbins & Myers Motor.

bread. It is also claimed that the pans are greased much more uniformly than where they are greased by hand, with a saving in lard and the elimination of any loaves sticking to the pan. With the machine, one-half pound of lard will grease 2,000 pans.

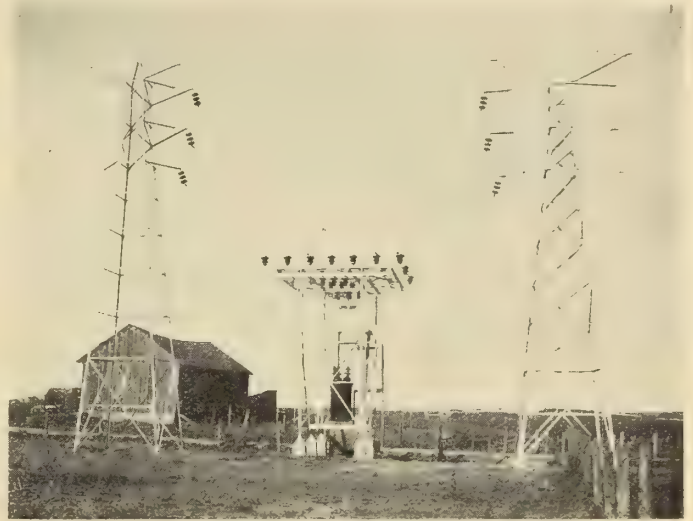
The machines are equipped with one-quarter and one-half horse-power motors, manufactured by the Robbins & Myers Company, Springfield, Ohio. The outfits are furnished with direct or belt connected motors as desired. The direct connected motors are equipped with back gears operating the brushes at the slow speed of 70 to 80 r.p.m. This means long life for the brushes and prevents any throwing of grease. The motor is mounted on the frame of the machine below the brushes and is protected from crumbs and grease by a metal cover. The outfit is mounted on casters so it can be moved about easily and connected to any lamp socket.

The average floor space required is 3 x 5 feet. Outfits can be furnished to suit pans of any shape or size.

#### 66,000-Volt Selector Type Outdoor Steel Tower Sub-station

The marked advance in the design and construction of high tension outdoor steel tower sub-stations during the past year is well illustrated by the installation shown herewith. This station, having an initial capacity of 100 kw. and an ultimate capacity of 1,000 kw., represents the latest development in low cost equipment, and will be a strong factor in selling power from transmission systems.

In order that the three-phase transformer can be energized from either of two sources of power, a standard trans-



66,000 Outdoor Sub-station.

mission tower was set off the right-of-way, and directly opposite a line tower—providing space for the double throw steel tower sub-station between. One set of three-phase line conductors was carried to the right hand tower, thus "splitting" the system, and offering a ready means for carrying taps to the sub-station without crossing of the phase wires. The three-phase switches are of the interlocked selector type, permitting power to be fed from either source without danger of throwing the switch systems together.

Protection is secured by means of choke coils, horn gaps and carbon-tetrachloride fuses on the high tension side, the low tension side being controlled by an automatic 2,200-volt oil switch located in a small house at the base of the sub-station. This house also provides space for meters, spare parts, distribution switches, etc. The transformer rests on a transfer table, insuring ready means for handling units, both during installation and when the station capacity is increased. The 2,200-volt secondary leads are carried under the transformer platform into the cement house, and then pass through conduit to the overhead secondary, or town distribution.

This complete sub-station, known as the "ready-made" type, is the standard type "CAG" form, manufactured by the Delta-Star Electric Company, Chicago, the Canadian sales agents being the Moloney Electric Company of Canada, Limited, of Windsor, Ont.

The plant of the New Denver Power Company, Limited, Nelson district, which was destroyed by fire last July, is again in operation. The service at present is limited, but it is proposed to increase it as soon as business improves.

The Safety First Airbrake Company, Limited, has been incorporated with capital of \$300,000 and head office in Victoria, B.C.



# A New Protective Relay

By Mr. A. N. Smith

In induction motors the fuses which are inserted in the circuit for protection are practically valueless. This is due to the fact that the fuses are at least 50 per cent. greater than normal full load current. Probably two or three times full load current is the more common fuse capacity. In any case the currents that can flow without blowing the fuse can do considerable damage to the motor, even to the extent of totally burning out the windings. Similarly an induction motor when running will keep running with one fuse blown, taking a proportionately larger current on the still fused phase. If the motor is running over 50 per cent. full load on the still connected phase, and in practically every case this is so, there is a great possibility of a burn out before the other fuses blow. The latter possibility is probably the commonest of all, particularly in the case of star-delta motors which may have heavy fuses (perhaps none) on the starting side, and which, when thrown over to the running side, could continue running.

In view of this the relay described below has been evolved. Its effect is primarily to give an audible or visible signal of a dangerous condition, whether from overload or blown fuses, and to give this signal the instant the dangerous

and F. add vectorially causing a current which operates the alarms.

(b) Overload on one phase.—Should the overload only exist on one phase, either A. or C. will operate alarms similarly as described in paragraph (a). The relay is so de-

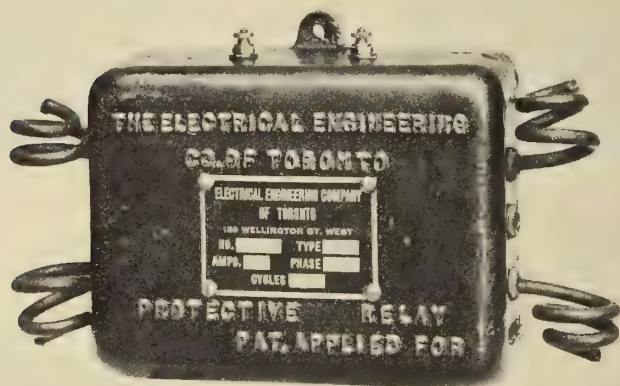


Fig. 1.

condition arises, not some time after, when heat has developed and possibly partially injured the motor. This latter point is where every thermal device fails, as it does not indicate until danger or damage has occurred, whereas in the relay described the indication is given the moment the dangerous condition occurs, and before any heat can develop.

## Description

Figs. 1 and 2 show relay ready for installation and Fig. 3 shows arrangements diagrammatically. Three laminated iron limbs, A., B. and C., are arranged with movable keepers, K. Limbs A. and C. have on them a winding inserted directly in the lines supplying motor (in large currents or high voltages series transformers are utilized). E. and F. are two secondary coils for ringing the bell, operating annunciator, or lighting the lamp. Any combination of above can be used. The external circuit of the secondary circuit, however, is only completed when either or both keepers are closed.

## Operation

(a) Overload on all phases.—When all phases are more or less equally overloaded at a pre-determined setting, say 25 per cent. overload, both keepers are attracted to the limbs A. and C. closing the secondary circuit through the keepers K. at points L. and M. We then have practically a three phase transformer and the secondary voltages in E.

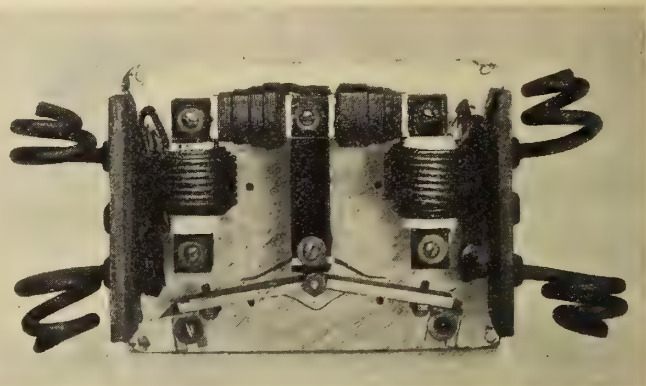


Fig. 2.

signed that ample energy for the alarms can be supplied by either coils E. or F. alone.

(c) Blown fuses.—Should a fuse be blown in either of the lines A. or C. the other limb would operate the moment the current reaches the predetermined setting, this being the dangerous condition. If the current is less than this setting, conditions are not dangerous and relay remains inoperative. If the fuse is blown in the line not introduced into the relay then both limbs A. and C. have to carry the heavier current and when it reaches that for which the relay is set, the keepers operate, thus giving the warning.

We would particularly point out that the relay will re-

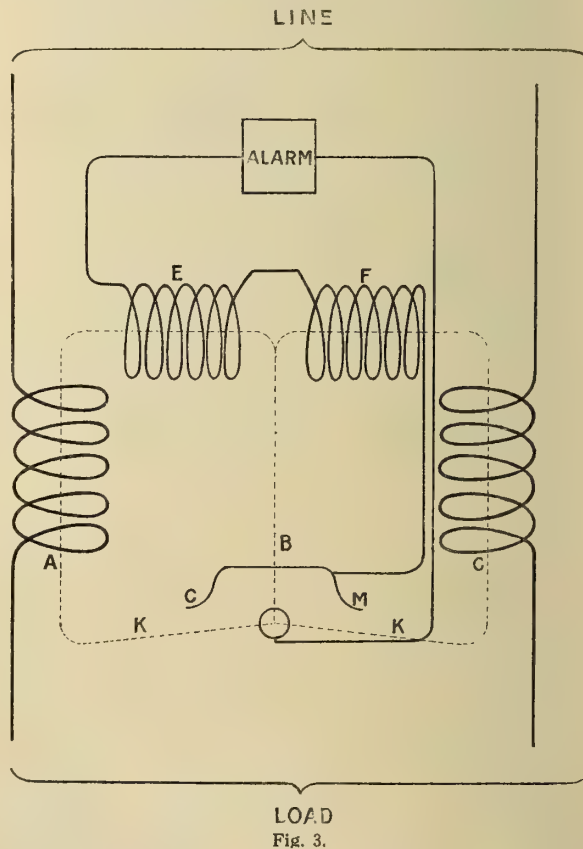


Fig. 3.

set itself, cutting out the alarms, when the current has fallen a predetermined amount, varying from 15 per cent. diminution, down to no-load current, as may be required according to the conditions.

The alarms or signal may be placed near the motor, or



at a remote distance, in, say, the superintendent's office, and since the secondary coils give a voltage of approximately 20 volts, duplicate sets can be arranged, one near the motor, and one a distance away. It should be especially noted there are no dry cells or batteries required, as where one has to rely on such apparatus, the protective value is considerably diminished due to possible troubles and failures of the secondary circuits. The relay as designed is self exciting, needing the simplest wiring with the minimum of attention, and as long as current is flowing there is energy enough to operate the alarms. The relay is exceedingly compact, being contained in a neat wall mounting cast iron case.

This apparatus can be adapted to various uses, a few of which are given below.

(1) As a warning device, visual or audible, of overload or blown fuses.

(2) To convert existing no-volt breaker or starter into combination over-load and no-volt, the no-volt coil circuit being closed through special contacts, which are opened when a dangerous condition arises so tripping the breaker.

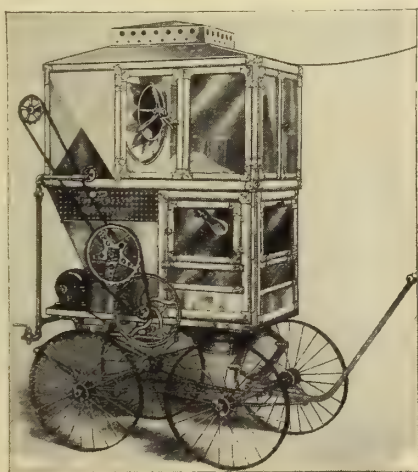
(3) For use on three phase transformers or banks of transformers as per items 1 and 2.

(4) For use in picture theatres where motor-generators are used, preventing the operator from freezing his carbons and so overloading and damaging the motor generator.

Modified designs have been built making the relay suitable for single phase and two phase current as well as that described, which was for three phase current. The whole scheme was designed by the Electrical Engineering Company, 130 Wellington Street West, Toronto, where they are prepared to demonstrate its many valuable features.

#### A Motor-Driven Peanut Roaster and Corn Popper

Advertising prestige pays in every line of business. Even the peanut and pop corn vendor has found that style is a great profit maker. He is now no longer satisfied with humble equipment, but demands an outfit that will raise him to the level of the great mercantile establishments around which he plies his trade. To meet this demand the Kingery Manufacturing Company, Cincinnati, Ohio, has provided a peanut and pop corn cart "de luxe," glittering in nickel and



The scientific pop-corn vendor.

plate glass illuminated with electric lamps at night, and operated by a Westinghouse Electric small motor. Current is obtained from a plug at the vendor's stand. The motor drives the peanut roaster and the rotary corn popper. Heat is obtained from gas or gasoline. These carts form a small but attractive load for central stations, as connections are easily installed and there is no meter to read, flat rates being usual-

ly charged. The cost of the cart is reasonable while payments can be made on easy terms.

#### Encouraging Local Industries

In an effort to encourage and support, as far as possible, local industries in Victoria and vicinity, a Fair was held in the Drill Hall on 22nd, 23rd and 24th of October, and was participated in by practically all of the manufacturers and



Section of Electrical display at Victoria Fair

merchants in the community. This affair proved a great success.

The accompanying photograph shows part of the Electrical display arranged for on the occasion. This exhibit was the result of co-operation between the B. C. Electric Railway Company and the local electrical dealers and formed a very interesting feature during the Fair. Demonstrations of all appliances were carried out, and between six and seven thousand people attended on the 3 days during which the exhibition was open. On the last day about 300 ladies were served with refreshments prepared on electric ranges.

#### Industrial Controller Company

The name of the Independent Electric Manufacturing Company, has been officially changed to the Industrial Controller Company. The increasing use of the company's apparatus with the industrial concerns throughout the country, and for industrial purposes, has made it seem advisable to change the name of the company so that it might better describe the product. There will be no change in the personnel of the company, and the trade mark, I-C, will remain the same.

#### Controlled Boat in 28 Mile Radius

John Hays Hammond, son of the mining engineer, has invented a radio boat which, he says, will revolutionize naval warfare. A successful test was made November 21, when the boat, named the Natalie, unmanned, was set loose near Graves light, just outside Boston harbor. Working his wireless station at Gloucester, twenty-eight miles away, Mr. Hammond steered the boat at will.

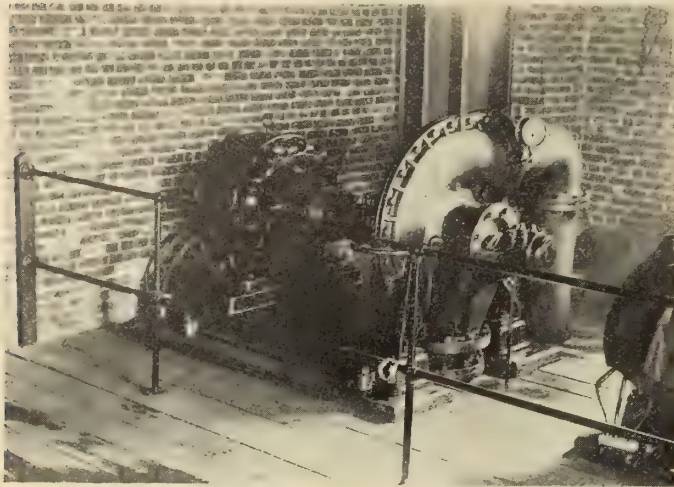
#### Use for Reducing Taxes

A movement headed by the city of Berlin, which is receiving a certain amount of support in other towns in the hydro area, is being made to influence the local legislature to so amend the Public Utilities Act that hydro-electric surpluses may be devoted towards a reduction of the general tax rate.



### 2000 Gal. Motor-driven Pump

The pump shown in the accompanying photograph was supplied by Boving & Company of Canada, Limited, to the municipality of Burnaby, B.C. The capacity is 2,000 gallons per minute, against an 80 ft. head. The pump is direct connected to a 75 h.p. Westinghouse, 3-phase, 60 cycle, 220 volt



New pump for Burnaby, B.C., waterworks.

induction motor, by means of flexible coupling. Motor is controlled by Westinghouse automatic starter. Installed complete by R. F. Mather, British Columbia representative of Boving & Company of Canada.

### Metal Sign Receptacle

Paiste No. 61777 Sign Receptacle, illustrated herewith, has been designed to meet the requirements of a large sign company. The shoulders for the holding screws have been made very much heavier to withstand all the wrenching which they receive. The special feature of this receptacle, outside of its strength, is the wide slots and the guide that lead the holding screws down to the nut. This makes it very



easy to put the holding screws in, and saves a great deal of workman's time. The nuts for the holding screws are fastened in place by clips so that they cannot get out of position. The centre contact is of phosphor bronze as in all Paiste sockets and receptacles. This receptacle is sold by the Hart & Hegeman Manufacturing Company, Hartford, Conn., and in Canada by the Canadian General Electric Company.

### Shaydolite

"Shaydolite" is an English lacquer of great value in coloring glass used in electric fixtures and decorations. It is made in various colors, one characteristic being that it does not interfere with the transparent qualities of the glass. To color lamps, they have simply to be dipped into a bowl of Shaydolite until submerged, and dried with the current turned on. The lacquer is used by the Canadian Government and Canadian railways and has also been supplied to the Royal Palaces and the British Navy for decorative purposes. The Spielmann Agencies, Limited, of Montreal, are the Canadian agents.

### Larger Quarters in Walkerville

The Detroit Fuse and Manufacturing Company announce that they have been forced to find a more suitable location giving them much more space than they had available in Windsor, and that they have now located in Walkerville, Ont., where they will carry a complete line of the Detroit Arcless fuses, switches and motor starters. Mr. Plate who has been connected with the main office of this company for some time will have complete charge of the Windsor branch.

### U.S. Electrics in England

The Baker Motor Vehicle Company, Cleveland, O., have recently closed negotiations with the Wolseley Motors, Limited, to represent it in England. The new agents expect to operate particularly with trucks as the conditions in England at this time are said to be especially favorable for this type of vehicle. They now have in operation a number of Baker trucks as demonstrators and will begin at once to handle their sale.

The British Canadian Engineering & Supply Company, Limited, have just set in operation an electric lighting plant in the town of Broadview, Sask., which consists of a 72 brake h.p. Ruston Proctor suction gas engine and producer plant; a 50 kw. Westinghouse generator, three-phase, 60-cycle, 2,300 volts complete with necessary exciter and two panel switch-board; also regulator transformer for series tungsten street lighting system. The above company installed the whole equipment including poles, pole line, transformers and meters.

### Trade Publications

**Gas Electric Cars**—Bulletin 44300, issued by the Canadian General Electric Company, describing and illustrating gas electric motor cars and locomotives.

**Station Devices**—Folder issued by the General Devices & Fittings Company, Chicago, illustrating profusely and briefly describing, their lines of high and low tension station devices.

**Section Insulators**—Folder distributed by the Ohio Brass Company, Mansfield, Ohio, illustrating three features of the O-B Type C section insulator that saves linemen's time and interruption of service.

**Railway Apparatus**—Treatise issued by the Canadian General Electric Company, entitled "Modern Electric Railway Apparatus." A number of recent noteworthy installations are illustrated and described.

**Street Lighting**—Hand booklet issued by the Canadian General Electric Company, illustrating and describing the attractive lighting of a number of prominent business streets at different points on the North American continent.

**Cable End Bells**—Bulletin number 102, being distributed by the Electrical Engineers Equipment Company, of Chicago, describing and illustrating cable end bells, all voltages and shapes for inside, outside and underground service. The same company have issued bulletin 103, describing and illustrating Bus Bar Supports able to carry various forms of buses. This bulletin is splendidly illustrated in two colors.

### Personal

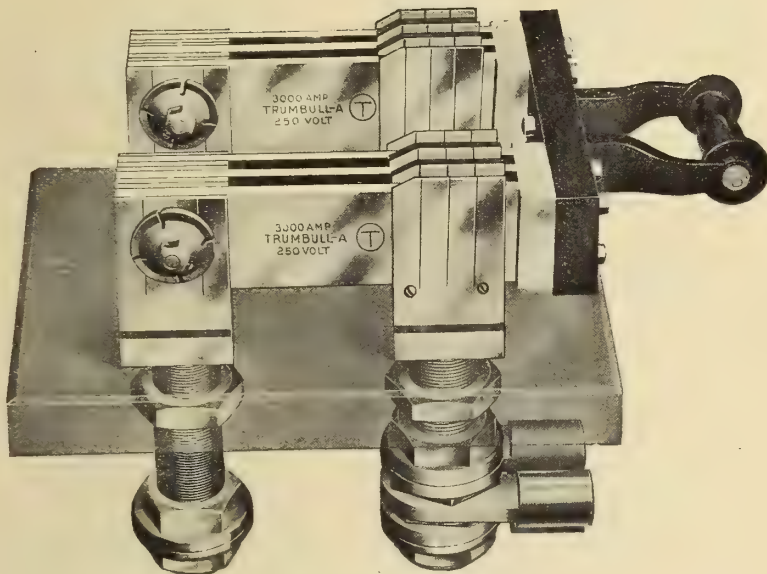
**Colonel J. G. Monahan, A.I.E.E.**, late western manager of Ferranti, Limited, with headquarters at Winnipeg, and Miss M. T. Grierson, of Toronto, were married at Los Angeles, Cal., November 24, where the bride has been visiting. Colonel Monahan has a host of friends among the business men of Winnipeg, who gave him a farewell dinner at the Fort Garry when he left for California last month.



# Ⓣ TRUMBULL Ⓣ

"CIRCLE T"

## Knife Switches



3000 Amp., 250 Volts. Type "A"

**30 to 5000 Amperes**  
(All Styles)

All current carrying parts of Trumbull Type "A" Switches are of pure drawn copper designed to carry easily 100 per cent. overload. The blades have strong reinforcing blocks at the ends, fastened by screws into the fibre cross-bar. The fibre is pre-shrunk by baking for several weeks. The patented handles cannot work loose.

Only the finest workmanship and material are employed in Trumbull manufacture and the most careful attention is given to the minutest details in assembling and adjustment.

We carry a stock of our standard material, packed and ready for immediate shipment upon receipt of order.

We manufacture a full line of Knife Switches, Snap Switches, Panel Boards, Cabinets, Switch Boards, Cut-Outs, Rosettes, Receptacles, Service Boxes, Insulating Joints and other Electrical Supplies. If you haven't a catalog, you should have one. Write for it today.



Motor Starting Switches showing straps on back.

## The Trumbull Electric Mfg. Co.

PLAINVILLE, CONN.

NEW YORK  
114-118 Liberty St.

CHICAGO  
15 S. Desplaines St.

BOSTON  
76-78 Pearl St.

PHILADELPHIA  
138 N. 10th St.

SAN FRANCISCO  
84-88 Second St.



# Current News and Notes

## Chilliwack, B.C.

The annual report of the Chilliwack Telephone Company, Limited, showed gross earnings, \$15,871; expenses, \$8,271; net earnings, \$7,600. After writing off for bad debts and depreciation \$3,860 remained for dividends which on a capital of \$45,580 is approximately 8 per cent. A 7 per cent. dividend was declared.

## Dundas, Ont.

A contract for the erection of the local sub-station has been let to contractor Thos. Woods.

## Fort Frances, Ont.

The appeal of the Ontario and Minnesota Power Company against a recent decision of Mr. Justice Latchford re property assessment of this company in Fort Frances, has been dismissed by the Court of Appeal. The company deem themselves over assessed and have refused to pay the full amount of their taxes.

## Fort George, B.C.

The electric light system at this point was recently destroyed by fire. It is expected that the Northern Interior Power Company will, in a few days, be in a position to provide a temporary supply of light.

## Hamilton, Ont.

The Hydro-electric Commission will advertise their list of electric household goods, between now and Christmas, according to a recent decision of the Board of Control.

The Bell Telephone Company and the Board of Control have agreed upon the terms by which the company shall be given another year of exclusive franchise in this city. It is understood that the company agrees to pay \$5,000 for the privilege.

The Hydro Power Commission will purchase fifty badges of a special design for employees of the department who have to visit private houses and places of business for the purpose of reading meters and inspecting wiring. This will protect power and light users against men other than employees of the commission gaining access to private buildings.

## Lambeth, Ont.

A by-law was recently passed authorizing the Village Council to spend \$4,000 on an electric distributing system.

## London, Ont.

The Board of Control of the city of London has recommended to the City Council that a request be made to the Dominion Railway Board for an order to have all wires placed underground in the down-town section of the city.

## Montreal, Que.

The Montreal Light, Heat and Power Company are about to organize a section of the Home Guard, supplying the arms and accoutrements.

The Canadian Hart Accumulator Company, Limited, have taken offices at 301 Guarantee Trust Building, Montreal. Mr. A. H. Box is the secretary.

It is understood the City of Quebec will ask the Provincial Legislature for power to raise a loan to purchase the plant of the Dorchester Electric Company, Quebec, the price being stated at one million dollars. It is said however that in the meantime negotiations are proceeding between the

company and the Shawinigan Water and Power Company for the acquisition of the Dorchester company by the Shawinigan.

## Mount Brydges, Ont.

On November 23rd the ratepayers voted by 73 to 3 in favor of closing a contract with the Hydro-electric Power Commission of Ontario.

## Niagara Falls, Ont.

Contracts have been awarded for the equipment necessary in the installation of a modern street lighting system. Standards are being supplied by the Pollard Manufacturing Company. The Northern Electric Company will supply the cables, the Westinghouse Company, two regulators and other auxiliary equipment.

## Newmarket, Ont.

The Council has decided to submit a by-law on January 4th, authorizing an expenditure of \$15,000 on the construction of a sub-station to be used in connection with a supply of power to be received through the Hydro-electric Power Commission of Ontario.

## Orillia, Ont.

The Council have requested the commission to install some fifty 100-watt tungsten lamps, distributing them on both sides of the main street from Andrew Street to the lake. The question of making use of the poles of the Bell Telephone Company will be taken up with that company.

## Ottawa, Ont.

The McDonald Hydro-electric Heating Company, Limited, have been granted a license.

## Peterborough, Ont.

The Canadian General Electric Company have undertaken to construct buildings and install machinery to an estimated cost of \$150,000, in return for which the city agree to take care of the rental of about three miles of the unused Chemong section of the Grand Trunk Railway line, which the Canadian General Electric Company will use for testing purposes for the electric locomotives they propose to manufacture. The expenditure incurred by the city will be approximately \$115 a year, in return for which they will receive one of the most promising industries in the electrical trade to-day.

## Renfrew, Ont.

The Renfrew Electric Manufacturing Company has finished its first year with a satisfactory balance sheet. A dividend of eight per cent. will be paid and the balance carried to reserve account. Thomas A. Lowe was re-elected president and Dr. Connolly, W. T. Guest and J. A. Jamieson were again chosen directors.

## Saskatoon, Sask.

It is expected that the city's electric light and power and waterworks departments will show very ample surpluses for the first ten months of the present year, and that figures to be submitted shortly to the council will bring about marked reductions in rates. During last month, for instance, the electric light department showed a surplus of over \$6,000, while, for the entire year, it is estimated that the waterworks will yield a profit of not less than \$14,000.

## Smithville, Ont.

A largely attended meeting of the ratepayers of the new-



# UNDERGROUND CABLES

## LOW AND HIGH TENSION

FOR LIGHTING,  
POWER,  
STREET-  
RAILWAYS,  
TELEPHONE,  
TELEGRAPH.



ARMoured  
CABLES FOR  
STREET  
LIGHTING,  
PAPER  
INSULATED  
CABLES OF ALL  
DESCRIPTIONS,  
RUBBER INSULA-  
TED CABLES &c.

Also Bare and Weatherproof Wires and Cables,  
Magnet Wire, Flexible Cords, &c.

### Galvanized Iron Wire and Strand

HEAD OFFICE:

## MONTREAL, CANADA

BRANCHES:

Toronto,

Winnipeg,

Halifax,

Vancouver.



ly incorporated village of Smithville, was held recently, and it was decided to request the Hydro-electric Power Commission of Ontario to prepare an estimate of the cost of a supply of light to the village and surrounding township.

#### St. Catharines, Ont.

The St. Catharines Hydro Commission will purchase a pulmotor for use in case of accident through any employee or citizen coming in contact with electric wires.

#### St. Marys, Ont.

The Water, Light and Heat Commission contemplate extending the electric lighting system a mile and a half along Widder Street.

Estimates are being prepared on the cost of giving a service to the village of Rannock where it is believed there is a market for fifteen or twenty horse-power.

#### Strathroy, Ont.

Hydro-electric power was turned on in this town on Monday evening, November 30th.

#### Sydney, N.S.

From Sydney, N.S., comes the gratifying report that two thousand men are employed at the Dominion Steel Company's plant. This is more than two-thirds of the full force in the busiest times. Rod, bar, nail, wire and billet mills are working full time, double shift, and a ten thousand ton order of rails is being rolled. Four shipments of wire have been sent to England, and other shipments will follow as soon as possible.

#### Toronto, Ont.

A number of new lamps are being installed around the Parliament Buildings. These consist of nitrogen filled tungstens on attractive pillars.

It is rumored that negotiations are under way for the merging of the telegraph system of the Great North Western Telegraph Company and the Canadian Northern Railway Company.

The Toronto-Hamilton Highways Commission, of which Mr. George Gooderham, of Toronto, is Chairman, have under consideration draft plans for a high level bridge at Carroll's Point, Hamilton, Ont. The plans were prepared by the Hamilton Bridge Company and the estimated cost is \$327,000. The proposed undertaking will be financed by the city of Hamilton and the County of Wentworth.

At a recent meeting of the Tramways Association of Great Britain, a suggestion was made regarding the introduction of rubber or some other silent material for street car tires, with the object of eliminating noise and vibration.

#### Vancouver, B.C.

The Farmers' Telephone Company, Limited, of Steves-

ton, Lulu Island, is in the hands of a liquidator who will on and after December 10th proceed to distribute such assets as may then be available.

The municipal council of Point Grey recently amended its electric wiring by-law so as to conform with the requirements of the city of Vancouver, where the rules are exceedingly stringent.

The Yellowhead Light & Power Company, Limited, with offices at 415 Winch Building, Vancouver, has made application to the provincial recorder at Barkersville, Cariboo District, for a license to store water for power purposes. The proposed point of diversion is approximately three miles by river from the junction of the Moose and Fraser rivers, at the foot of the first falls. It is proposed to erect four dams for holding purposes, the estimated capacity of the reservoirs in acre feet and approximate area of land to be flooded being as follows: Reservoir above Dam No. 1, 600 acres, 24,000 acre feet; reservoir, Dam No. 2, 500 acres, 20,000 acre feet; reservoir Dam No. 3, 625 acres, 14,000 acre feet; reservoir Dam No. 4, 4,340 acres, 7,000 acre feet.

#### Victoria, B.C.

The fire wardens' committee of the City Council has recommended the installation of a larger capacity fire alarm system. This system would incur a cost of about \$10,000.

#### Wallaceburg, Ont.

Work has commenced on the erection of the Wallaceburg hydro-electric sub-station. It will be located on King Street. Some work has also been done on the erection of poles.

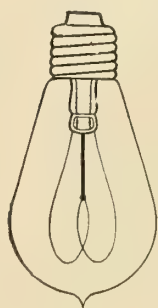
#### Waterford, Ont.

Work has started on a small hydro-electric sub-station building being erected at this point by the contracting firm of Wells and Gray.

#### Pipe Taplet Tap Block

A new tap block has been designed for Paiste pipe taplets, which will fit all way down in the taplet, although there is plenty of space under it for a third wire. This tap block does away with all soldering, either of branch wires to the main wire, or of tap wires for fittings. The main wires are bared for  $\frac{3}{8}$  of an inch, and fastened to the binding screws of the tap block. The tap or branch wires are fastened to the connecting binding screws. These tap blocks are approved, and make a very safe joint without any risk of short circuiting. One size fits both  $\frac{1}{2}$ -in. and  $\frac{3}{4}$ -in. pipe taplets.

The Hart & Hegeman Manufacturing Company are sole selling agents for Paiste fittings which are handled in Canada by the Canadian General Electric Company.



## NEW PRICES Tungsten and Carbon Lamps

Send for Bulletin "K"

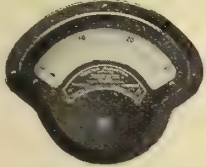


**VOLT ELECTRIC COMPANY, LIMITED**  
37-41 Britain Street, TORONTO, ONT.





Model 280, Single Range  
Portable Voltmeter.  
(One-quarter size.)



Model 267, Switchboard  
Ammeter.  
(One-quarter size.)

They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity.  
They are substantially constructed and may be safely sent long distances through the mails and will withstand an extraordinary amount of vibration without injury.  
They have the longest scale ever provided in instruments with equal length of pointer.  
Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year.  
The portable instruments may be conveniently carried in the coat pocket.  
The prices have been established upon so low a scale that any one may possess one or more of these remarkable instruments at moderate cost.

If you cannot obtain the instrument desired from your dealer, write us.

The several models and ranges offer a selection from over 300 different combinations, listed in Bulletin No. 8. Will be mailed upon request.

### WESTON ELECTRICAL INSTRUMENT COMPANY, Main Office and Works, NEWARK, N.J.

Mr. Stanley Brown, 114 Liberty  
St., New York City.  
Badt-Westburg Elec. Co., 832  
Monadnock Block, Chicago, Ill.  
Mr. F. E. Gilbert, 303-4 Hale  
Bldg., 1326 Chestnut St., Phila-  
delphia, Pa.  
Mr. Geo. H. Moseman, 176 Feder-  
al St., Boston, Mass.

Mr. Milton Mill, 915 Olive St.,  
St. Louis, Mo.  
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Mr. Frank E. Smith, 682 Mis-  
sion St., San Francisco, Cal.  
Mr. S. C. Dinsmore, 1933 Dime  
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Walter P. Ambros Company, 1729

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A. H. Winter Joyner, Ltd., No.  
76 Bay St., Toronto, Canada.  
Weston Instrument Co., Ltd.,  
Geneststrasse 5, Schoneberg, Ber-  
lin, Germany.  
Mr. D. R. Petest, 415 Fourth  
Nat'l Bank Bldg., Atlanta, Ga.  
Mr. Edwin Wortham, Suite 28

Allison Building, 8th St. and Main  
St., Richmond, Va.  
Montreal  
Winnipeg  
Vancouver  
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Northern Electric Company  
Limited  
Weston Electrical Instrument  
Co., Audrey House, Ely Place,  
Holborn, London, E.C.

# WESTON

## Miniature Precision Instruments for Direct Current

A new group of very small Indicating Instruments.

COMPACT—ACCURATE—DURABLE—BEAUTIFUL

### PORTABLE

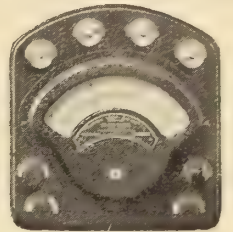
Voltmeters, Millivoltmeters, Volt-Ammeters, Ammeters, Mil-Ammeters are supplied in single, double and triple ranges.  
The Volt-Ammeter comprising six instruments in one.  
This group also includes BATTERY TESTERS.

### SWITCHBOARD

This new line of instruments represents the latest development of the pivoted moving coil, permanent magnet type for low ranges.  
The refinement of design and mechanical work in them has been carried to a degree which would appear to be almost impossible of accomplishment, if the results were not evident in the instruments themselves.

They embody characteristics which have made the well known Weston Standards famous throughout the world.

They are accurate, dead beat and extremely sensitive.



Model 280, Triple Range  
Portable Volt-Ammeter.  
(One-quarter size.)

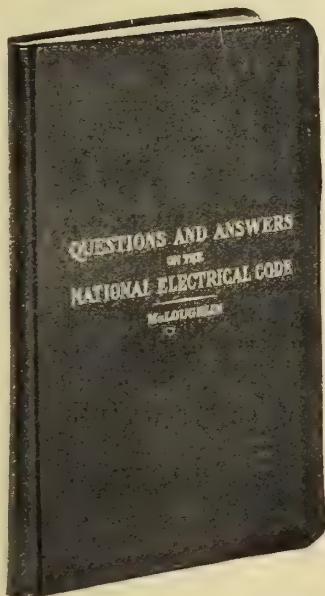


Model 268, Switchboard  
Volt-Ammeter. Reads  
Amperes. Press Button  
for Volts.  
(One-quarter size.)

## You Can Interpret the Code Instantly with McLoughlin's

## Questions and Answers on the

## National Electrical Code



It tells at once the answer to the questions on code requirements.

Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.

Every question is carefully indexed so that you can locate the fact you are after instantly.

Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.

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Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.

The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding \$1.00 net, prepaid.

For Sale by

Electrical News,

347 Adelaide Street West, Toronto



# Condensed Department

## Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at \$2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

Meter and instrument man desires position with power company; experienced in repair and test work on switchboard instruments and service meters or as switchboard operator. Apply Box No. 90, Electrical News, Toronto. 23-24

We are looking for a capable man for translating our catalogues and pamphlets into English, Spanish, and if possible also German and Russian.

Only applications from really competent man with experience will be considered.

Apply with full details of age, qualifications, education, experience and salary expected, to

ALLMANNA SVENSKA ELECTRIC CO.,  
Vasteras, Sweden. 24

## HYDRO TENDERS

Tenders for Single Phase Regulators will be received until noon of Thursday, December 17th. Address to the Chairman of the Toronto Electric Commissioners. Specifications and form of tender can be obtained at the office of the Purchasing Agent. The lowest or any tender not necessarily accepted. 24

## Sales Engineers Wanted

A large firm specializing in the manufacture of motors of all classes desires to secure sales engineers in various parts of Canada. Firms who can carry a stock of motors are preferred. Write stating the territory that you can cover. Box 96, Electrical News, Toronto. 21-24

## Electrical Machinery

Motors, Dynamos, Generators,  
Electrical Pumps and Supplies.  
Electrical Contractors.  
Motor Repairs



52 Queen Street - OTTAWA

## SECOND HAND ELECTRICAL MACHINERY

Bought, sold, rented, and exchanged. We have the largest stock in America. Send for our monthly bargain sheet showing complete stock with our prices.



Established 1893



PROCURED IN ALL  
COUNTRIES  
LONG EXPERIENCE  
IN PATENT LITIGATION

SEND FOR HAND BOOK

**PATENTS** PHONE  
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2582

RIDOUT & MAYBEE

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## "The Recognized Authority on Wiring and Construction"

—The Electrical Journals of the United States, Canada and England

Over 297,000 Sold

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20th Year

Fellow American Institute of Electrical Engineers; formerly  
Electrical Inspector for Boston Board of Fire Underwriters  
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20th Edition



## 1914 Standard Wiring

is the only book on Electric Light and Power Wiring and Construction endorsed and recommended by every Board of Fire Underwriters in the United States and Canada, because it is the only one kept strictly up-to-date and revised every year in accordance with every rule and requirement of the

## National Electrical Code

which it contains, explained and illustrated. The 1914 Edition has been completely revised from the first to the last page, and contains new illustrations, tables and diagrams in accordance with the latest and best practice.

"It settles disputes and, if referred to before wiring, prevents disputes."

Sent to any address,  
postpaid, on receipt of

**\$1.00**

Leather Cover  
Pocket Size

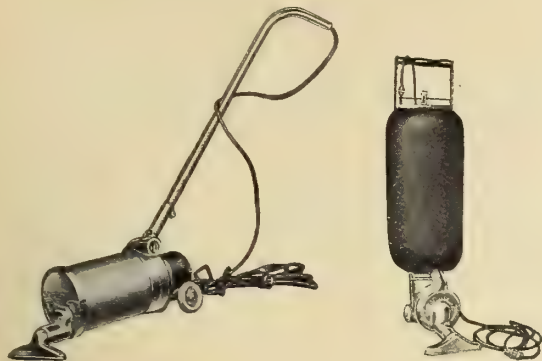
Electrical News,

347 Adelaide Street West,

Toronto, Canada

"The Best Book on Wiring Ever Produced"—E. T. BIRDSALL, M.E., A.I.E.E.





## Built With a Conscience Sold With a Guarantee

Sturtevant Vacuum Cleaners will satisfy your customer. They are built with a conscience. There's no slipshod construction—no parts thrown together merely to sell. Sturtevant Vacuum Cleaners are high grade machines—machines that are built to run—machines that will work six days a week and fifty-two weeks a year, and when once sold they stay sold. Each sale is a satisfied customer.

# Sturtevant

(REG. CAN. PAT. OFF.)

## Electric Vacuum Cleaners

are sold with a guarantee. We agree to repair or replace any part of the cleaner which proves to be defective within one year.

### We Want Agents

These cleaners are sold extensively in the United States under the name Western-Electric-Sturtevant, and are handled by a large number of power companies. They have been widely advertised in well known magazines and are now being advertised in Canadian popular magazines.



Vacuum Cleaners build up day load.

Sales arrangements satisfactory. Sales helps and advertising literature supplied. Write us at once.

**B. F. Sturtevant Co.  
of Canada**

Limited

Head Office and Works,  
GALT, ONT.

# Ornamental Lighting Standards

In this electrical age most cities are installing ornamental street lighting standards. A well lighted town is always a busy town and is destined to grow and prosper.

We have a very attractive line of standards and can supply stock or special designs at interesting prices.

During the past few months we have supplied ornamental lighting standards for the following places:—

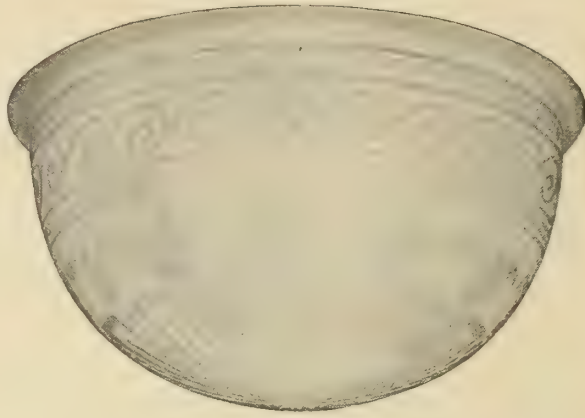
Brantford, Ontario  
Edmonton, Alta.  
Windsor, Ontario  
Outremont, Quebec  
London, Ontario  
Orillia, Ontario  
Listowel, Ontario  
Peterborough, Ontario  
Belleville, Ontario

*Write our lighting pole department  
for full information.*

**William Hamilton**  
Company, Limited  
Peterborough, Ont.



# Moonstone Glass



Etching No. 530.

Artistic and Efficient lighting is obtained by the proper selection of Glass.

We have many beautiful designs made of Moonstone Glass deep etched, finished in white or tints.

MADE IN CANADA

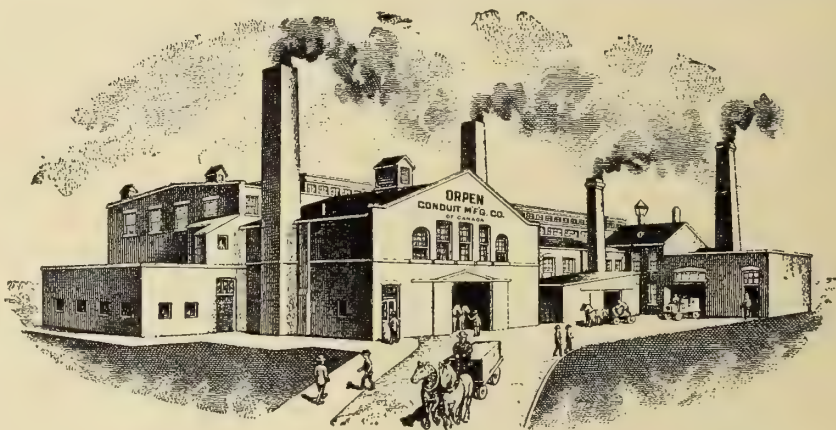
BY

## Jefferson Glass Co., Limited

Head Office and Works, TORONTO

Branch Sales Offices, Montreal, Winnipeg, Vancouver

MADE  
IN  
CANADA



BY  
CANADIAN  
LABOR

## XCELADUCT

THE CONDUIT OF NO REGRETS

### The Choice of Every Electrical Man

#### XCELADUCT

Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by COPPER-PLATING and zinc coating.

Clean threads and smooth enamelled interior allows rapid fishing.

#### ORPENITE

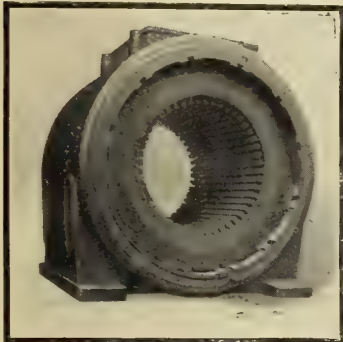
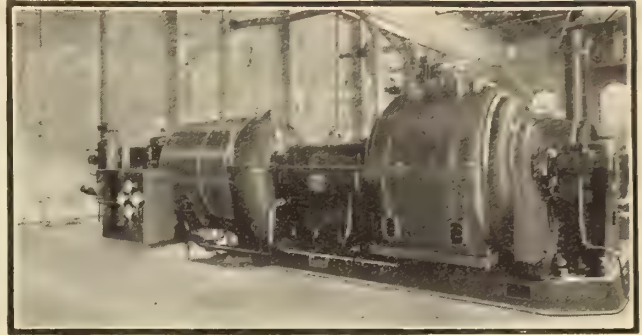
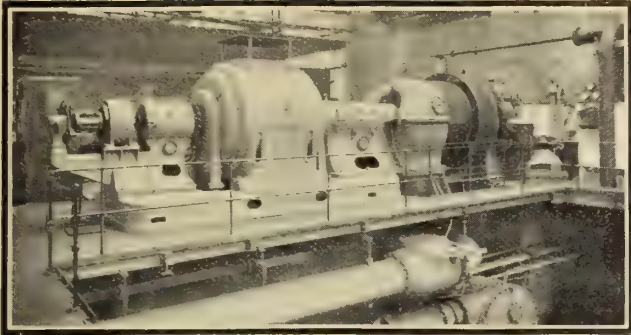
Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

# Orpen Conduit Company, Limited

TORONTO

ONTARIO



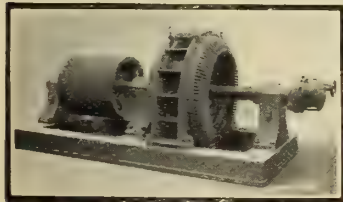
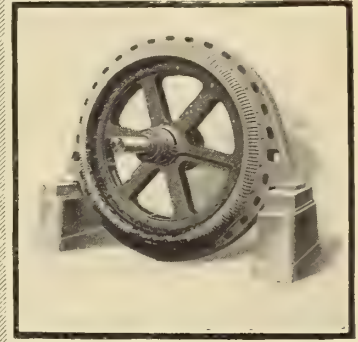


## VICKERS Limited

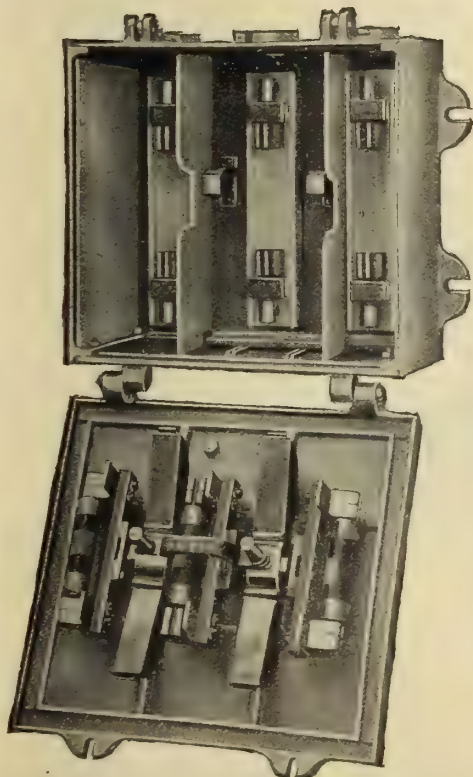
Head Office for Canada:  
Lewis Building, 20 Bleury Street, MONTREAL  
Mr. J. F. I. Thomas, (Representative)



RIVER DON WORKS, SHEFFIELD



ELECTRICAL EQUIPMENT  
of every description



## The FIRE HAZARD

Do not think only of loss by fire, but guard your employees against electrical accidents.

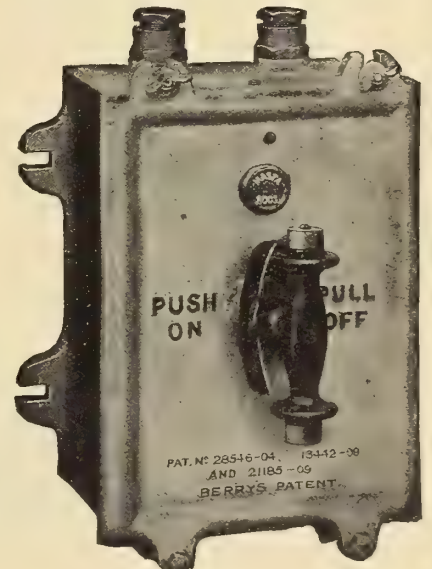
### BERRY'S PATENT

ironclad fuse-switch gear is used in every civilized part of the world, and is absolutely foolproof.

Write for particulars to the sole agents in your territory:—

FEDERAL ENGINEERING CO., Limited

GENERAL SUPPLIES, Limited



D. P. "Masta" Fused-Switch  
Weathertight Type.

122 Eleventh Avenue West, CALGARY

CANADIAN-BRITISH ENGINEERING Co., Limited.

324 Smith Street, WINNIPEG

T. P. "Masta" Patent Fused-Switch with  
National Standard Code Fuses.

Berry, Skinner & Company, 78 Upper Thames Street, London, E. C., England



# Let Us Light Your Factory

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We make  
**Motors and  
Generators**  
For All Circuits

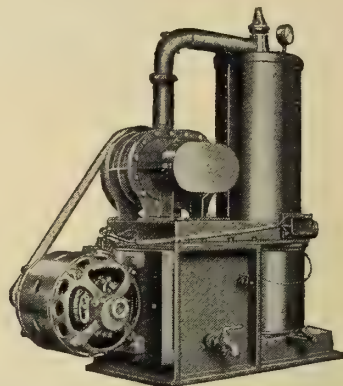
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WRITE  
**Toronto & Hamilton Electric Co.**  
HAMILTON, ONT.

*Century*

## Single Phase Motors

have been adopted as standard by many manufacturers of vacuum cleaners, because they are so quiet in operation and can be controlled from a distance by a push button or snap switch.



1 H.P. 1165 R.P.M. Motor belted to a Stationery Vacuum Cleaner

**THEY KEEP-A-RUNNING.**  
1/6 to 40 H.P.—25 to 140 cycles.

## Century Electric Company

19th, Pine to Olive Sts. ST. LOUIS, Mo.

CANADIAN AGENTS

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294 Adelaide St. W., Toronto  
Mainer Electric Co., Ltd.  
Winnipeg and Edmonton

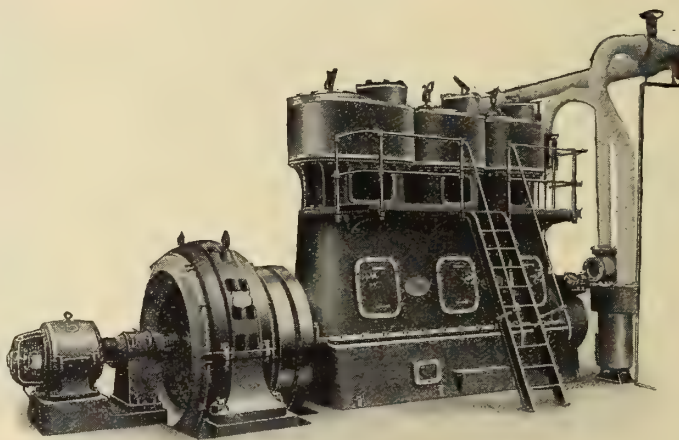
Rudel-Belnap Machy. Co., Ltd.  
Canadian Express Bldg., Mont  
Rankin & Cherrill  
547 Main St., Vancouver

144

We have a large stock of motors up to 100 H.P. in Toronto ready for immediate delivery

The "Lancashire" Ball Bearing Induction Motor and "Patent Reversing Drive for Metal Planers," will repay investigation.

Discriptive matter sent on request.



750 K.V.A. Alternator direct coupled to engine.

Accidents will happen, but a complete stock of spare parts and well equipped repair shop ensure users of "Lancashire" machines, minimum inconvenience from such breakdowns.

**The Lancashire Dynamo and Motor Co. of Canada, Ltd.**  
Montreal 107-109 Duke St., Toronto



TRY ONE OF OUR

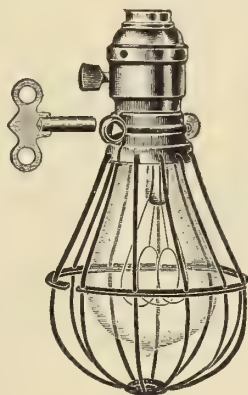
# MORRIS CHAIN BLOCKS

IT WILL GIVE YOU A LINE ON THEM ALL.

**THE HERBERT MORRIS CRANE  
& HOIST CO., LIMITED**

EMPRESS WORKS,

PETER STREET, TORONTO



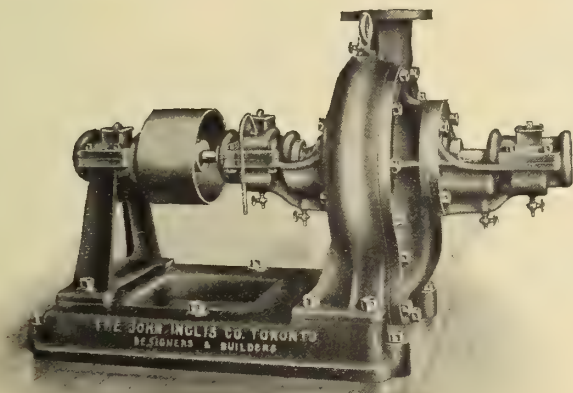
THE  
**LOXON**  
LAMP GUARD  
THE KEY TO SAFETY  
SUPPLIES A  
NATIONAL  
WANT

In factories, mills, warehouses, garages and other places where large numbers of lamps are in use, the owner is continually confronted with the problem of preserving his lamps from theft and breakage. For this reason the Loxon Lamp Guard is an investment of more than usual value for jobbers and dealers. The Loxon Guard combines strength of construction with a neat appearance. It prevents the theft and breakage of lamps, and eliminates all danger of fire arising from hot or broken lamps. The retail cost of the Loxon Guard is moderate and at the same time leaves a good profit for the dealer. Our catalogue of Electrical Specialties will be mailed on request.

*Get the genuine Loxon—Made only by*

**McGill Mfg. Co.** 5 Oak St.  
Valparaiso, Ind.

## "INGLIS" TURBINE PUMPS



"Inglis" Turbine Pumps are the best by actual test—our pumps are in operation from Coast to Coast and in every case are giving absolute satisfaction.

*Write us for prices*

Horizontal Belt Driven Turbine Pump Supplied  
Toronto University

**THE JOHN INGLIS CO., LIMITED**

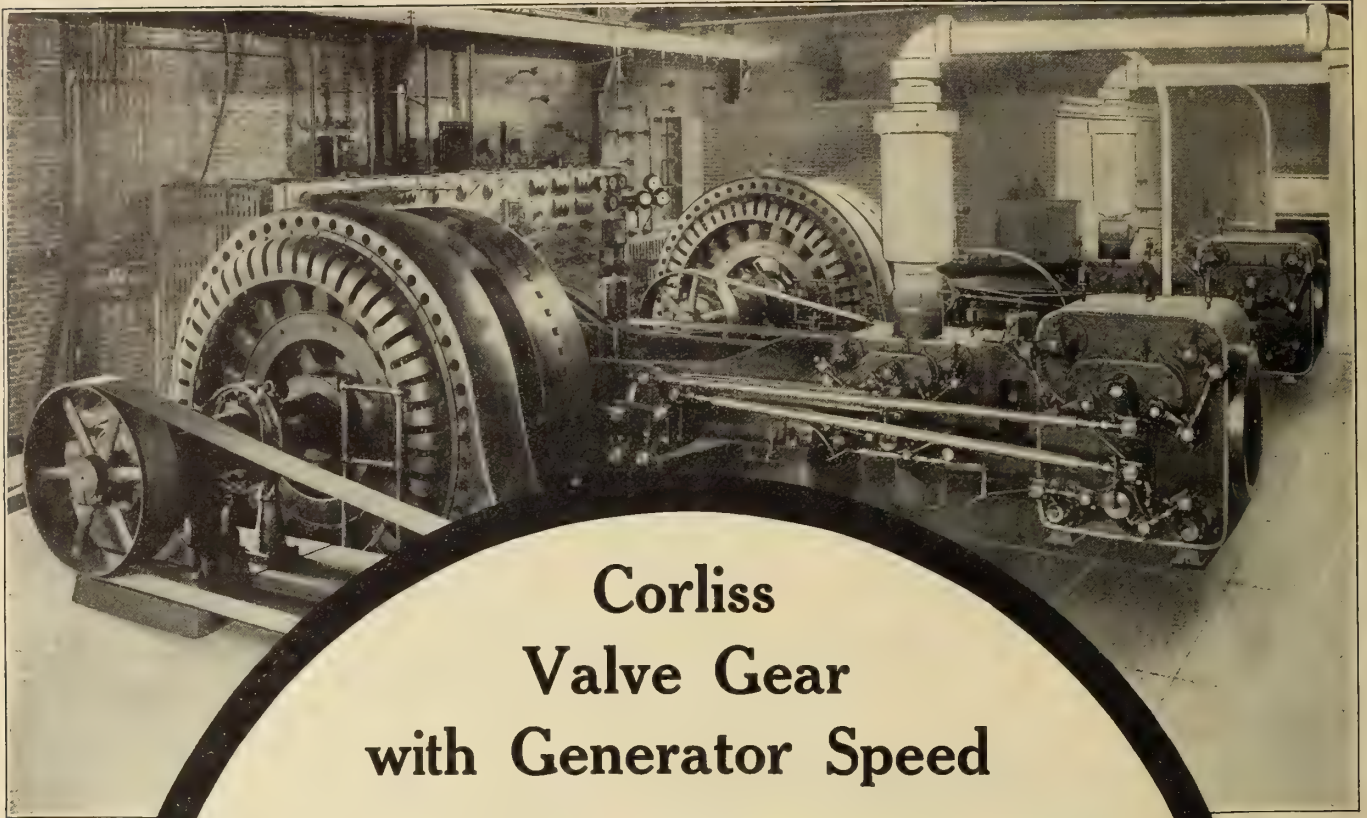
*Engineers and Boilermakers*

14 STRACHAN AVE.

TORONTO, CANADA

Montreal Office:—Room 509 Canadian Express Building





## Corliss Valve Gear with Generator Speed

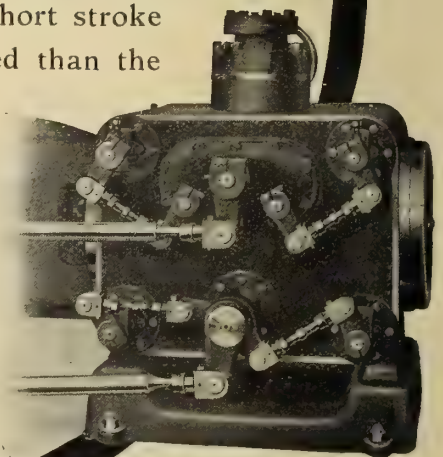
This feature distinguishes

# Robb Corliss Engines

A simplified valve gear, multiported valves, short stroke and compact frame permit a much higher speed than the ordinary form of Corliss gear.

Half as many parts to wear, no springs, no dash pots, no latches, no cams, no disengaging parts, — but Corliss steam distribution and small clearances.

Scotch Boilers  
Vertical Engines  
Horizontal Boilers  
Water Tube Boilers



## INTERNATIONAL ENGINEERING WORKS, LIMITED

FRAMINGHAM, MASS.

AMHERST, N.S.

Montreal

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Winnipeg

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**ADJUSTO SIGN  
DRAWS ATTENTION  
GETS RETURNS.**

The only successful  
**Electric Adjustable Sign**  
"Made in Canada"

A million sales ads and aids in one.

Write us for agency proposition.

**Canadian Steel Products Co.**  
227-229 Wellington Street Montreal

Manufacturers of steel cutout and panel boxes and other steel specialties.

## *Drawn Steel* **UNILETS**



**I**F this particular advertisement can induce you to place a trial order for "Unilets," then the object of the advertisement has been accomplished for we believe they are the most up-to-date conduit fittings on the market and will be readily adapted as your standard thereafter.

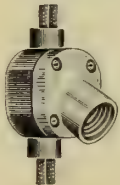
The claims we make for these fittings are so many that we will not endeavor to place them before you at this time, and the only way to prove their true value is to try them on your next job.

"Unilets" are packed in paper boxes, neatly labeled with the quantity, catalogue number, size and with an illustration of the fittings contained in the boxes.

Copy of our latest catalogue No. 7, also small booklet on "Unilets" sent upon request. Write us at once, addressing Dept. "D."

After your first trial, you will know what we mean when we say these fittings are much lighter in weight and stronger than cast-iron fittings. The reason for this is that "Unilets" are drawn from steel, are much more flexible and at the same time, allow more space for making connections, etc.

You will find in "Unilets" many points of superiority over and above other fittings. If you cannot secure your requirements through your jobber, write us and we will find a way to give you a trial of these fittings.



## **APPLETON ELECTRIC COMPANY**

Main Office and Factory, CHICAGO, 212-214 N. Jefferson Street

For sale in Canada by

THE MAINER ELECTRIC CO., LTD.  
WINNIPEG

MARSHALL-WELLS CO., LTD.  
WINNIPEG

CHAPMAN AND WALKER LTD.  
TORONTO

## **DOSSERT CONNECTORS AND TERMINALS**

are made in a wide range of forms and sizes, and to handle all sizes of wire from No. 10 to 2,500,000 C.M. conductors.

Their use as a factor of safety is increasing by the thousands each year, for the reason that they are designed for carrying overloads greater than the conductors which they connect. Tests have proven that the conductor will melt before a Dossert Connector will fail.

Dossert Connectors are being used in increasing thousands each year by those knowing the great variety, range and usefulness of these devices.

**DOSSERT & CO.,** 242 West 41st St., NEW YORK

H. B. LOGAN, PRESIDENT  
IRVING SMITH, Canadian Rep., Unity Bldg., MONTREAL



## **A Text Book for Gift Makers**

at any time, is our new booklet,  
"The Dainty Way to Keep House."

- ¶ It has interested thousands in lamp socket cooking and heating appliances of Simplex Quality.
- ¶ Your customers will be glad to receive it.

## **SIMPLEX ELECTRIC HEATING CO.**

Mfrs. of Everything for Electric Heating and Cooking  
BELLEVILLE, ONT.

CHICAGO, 15 S. Desplains St. CAMBRIDGE, MASS.  
SAN FRANCISCO, 612 Howard St.



# Canada Wire & Cable Co., Limited, Head Office and Works TORONTO

**Bare and Insulated Electrical Wires for all purposes**  
**Electric Railway Trolley Wire and Feeder Cable**

*Sales Offices and Branch Warehouses:*

401 Lake of the Woods Bldg., MONTREAL

150 Princess Street, WINNIPEG

Macdonald Marpole Company, Limited, 427 Seymour Street, VANCOUVER

*Prompt shipments from Factory or nearest warehouse.*

## John Starr, Son & Co.

Limited

158 Granville St. - HALIFAX, N. S.

## Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,  
CONDUIT, MOULDING, SWITCHES, CUT-  
OUTS, FIXTURES, ETC., ETC.

Large Stocks - Prompt Shipments

Write Us for Low Prices

## Street Illumination

By Multiple and  
Serie

## Pemco Fixtures

"The Practical Fixture"

*Send for Bulletin No. 7*

## Philadelphia Electric and Mfg. Company

PHILADELPHIA, PA.

Canadian Representative

A. H. Winter Joyner, Limited  
76 Bay Street, Toronto

## We Have a Bell For Every Purpose



There can be only one best and that is the Schwarze. No. 12 Common Magneto Extension for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire is all active. Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and very much louder, and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof.

Write for catalogue.

All resistances.

## Schwarze Electric Co., Adrian, Michigan

Norton Telephone Co., Canadian Agents



**M I C A**

Canadian Amber

Indian Ruby

**For Every Purpose**

Cut or uncut, stamped to pattern. Selected to cut any size or in regular grades. Splittings, Washers, Gramophone Discs. I also carry the largest stock of Stove Mica in Canada.

*Write for prices and samples.*

**S. O. FILLION**

Miner, Importer and Wholesale Dealer

86-88 Duke St. - OTTAWA, Canada

BRANCHES—34 West 33rd St., New York Kodarma, Bengal, India

**HIGH TENSION EQUIPMENT**  
**DISCONNECTS**  
**OUTDOOR -**  
**SUB-STATIONS**  
**STEEL TOWERS**

**POLE TOP SWITCHES**  
**CHOKE COILS**  
**FUSES**

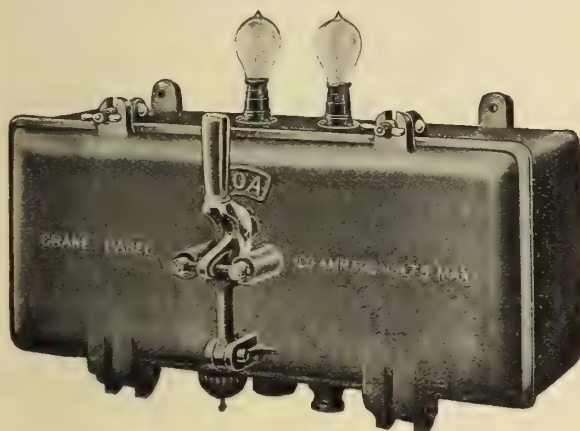
**LINE UNITS**  
**"UNITTYPE"**  
**BUS SUPPORTS**  
**ENTRANCE TUBES**

ASK FOR  
 TECHNICAL BULLETINS  
 GENERAL SALES AGENTS  
**MOLONEY ELECTRIC COMPANY**  
 OF CANADA LIMITED  
 MONTREAL-TORONTO-WINDSOR-WINNIPEG-VANCOUVER

DELTA STAR  
 ELECTRIC CO  
 CHICAGO

**Light Weight, Small Size,**

compact, and highly efficient. The main switch will give both a quick make and quick break and is unaffected by vibration.

**VICKERS CRANE PANELS**

consist of a D.P. main switch and fuses, branch fuses, plug and socket with switch and fuse for inspection lamp, and two pilot lamps.

Panels of 50 ampere size, for controlling a four motor crane, are only 10" high, 20" wide by 9" deep.

**The Electric & Ordnance**

Head Office for Canada

Lewis Bldg., 20 Bleury St., MONTREAL

**Accessories Co., Limited**

Works, Aston, Birmingham, England

Mr. J. F. I. Thomas (Representative)

**- M I C A -**

We can supply your requirements in

**Canadian Amber Mica**

Thumb Trimmed

Cut to Size

With our mines at Rideau Lakes and unexcelled shipping facilities by rail and water, we are in a position to supply your requirements on shortest notice.

**The Stoness-Anglin-Gilbert Mica Mining Co., Ltd.**

Head Office and Factory

Kingston Ontario Canada

**Tenders**

A few dollars spent in advertising your proposals in

**The Contract Record**

would result in additional competition, which might save your city or town or your client many hundreds of dollars.



## British Columbia Cedar Poles

### Open Tank Treated With AVENARIUS CARBOLINEUM


will double or treble the ordinary life of your line at a small cost. It will pay you to investigate. Ask for full information and our special folder.

## The Lindsley Brothers Company

"Good Poles Quick"

Spokane

Washington



**Cedar**

We are producers of  
Western Red Cedar and Northern  
White Cedar  
**POLES**  
Prompt shipments guaranteed.  
**Crawford Cedar Co.**  
Menominee, Mich.

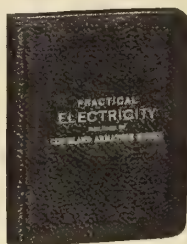
**Poles**

## ELECTRICAL MACHINERY

AND REPAIRS

Armatures Complete  
Armatures Rewound  
Armature Coils  
Armature Shafts  
Field Coils

Commutators New,  
Refilled or Assembled



Every electrician  
should have a  
copy of this book.  
Price - \$2.00  
delivered

CLEVELAND ARMATURE WORKS, Cleveland, Ohio

## MICA

### KENT BROTHERS

Kingston, Ont., Canada

Miners, Exporters and Dealers in  
Canadian Amber Mica.

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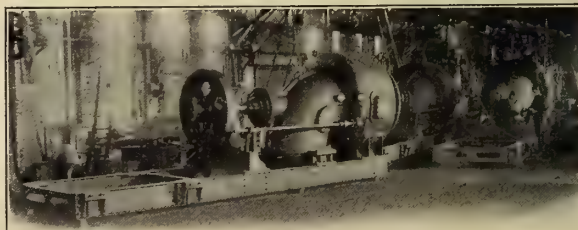
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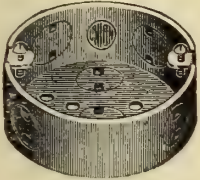
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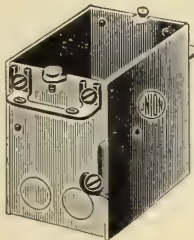


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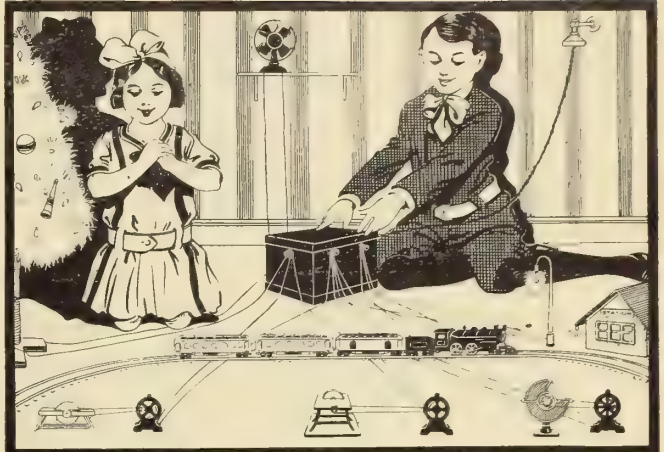
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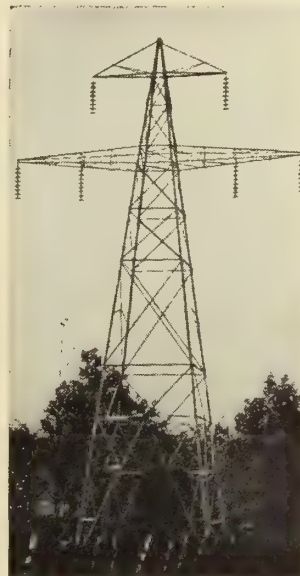
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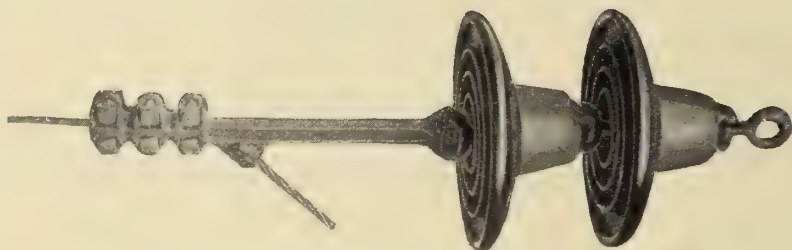
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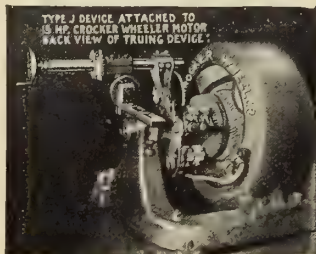
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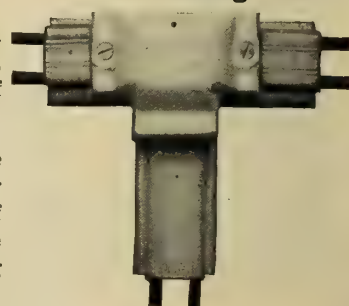
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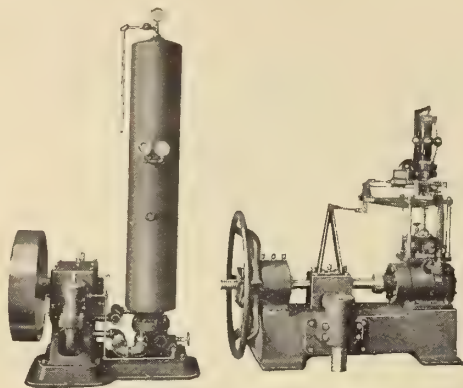
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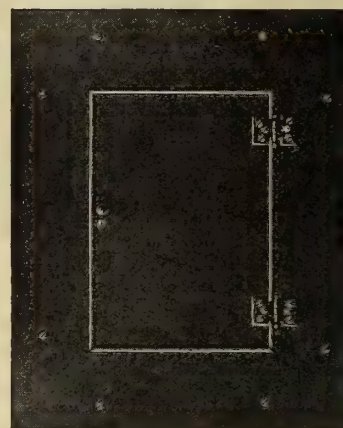
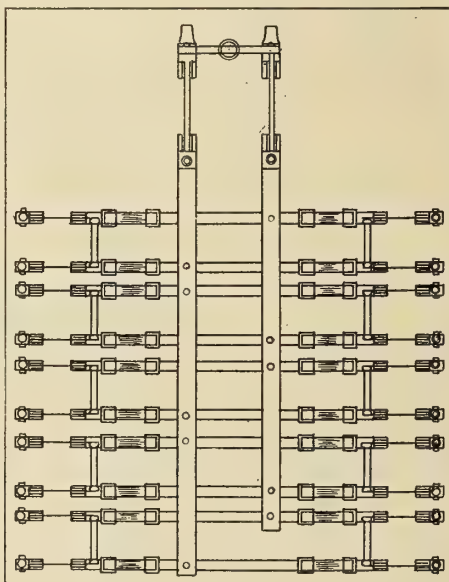
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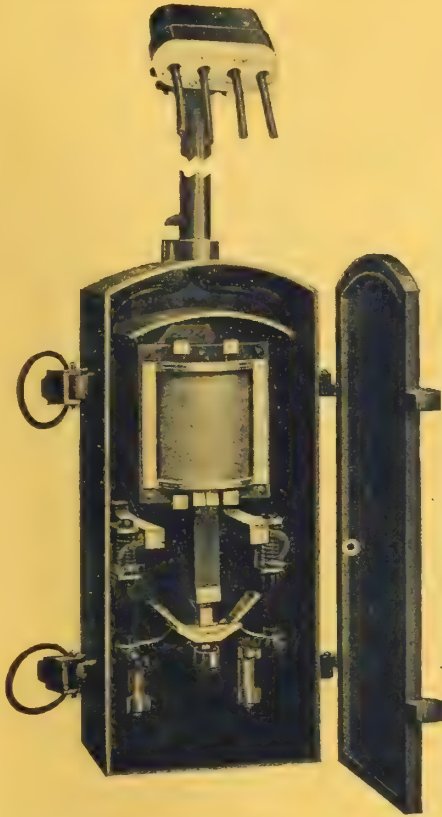
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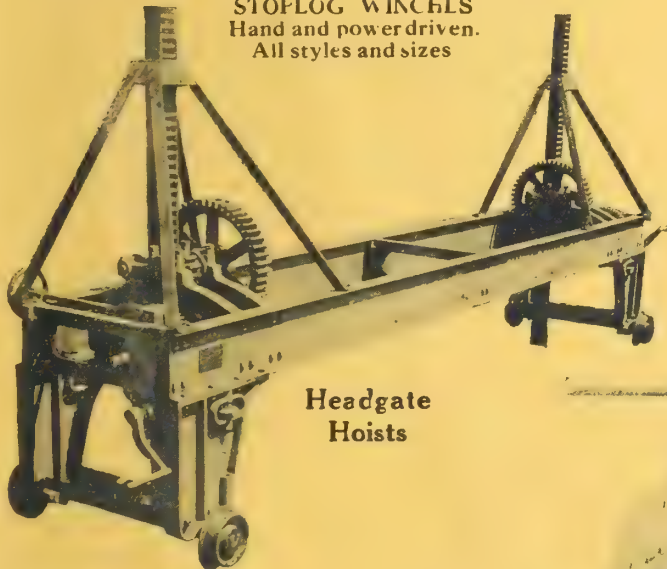
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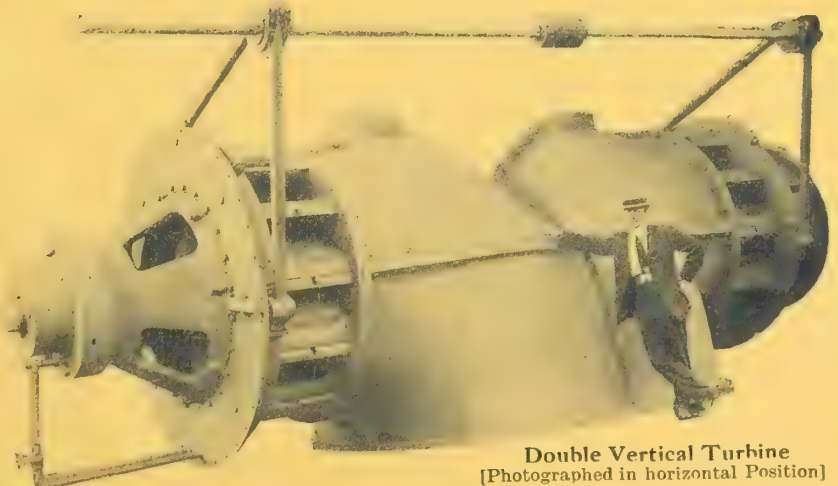
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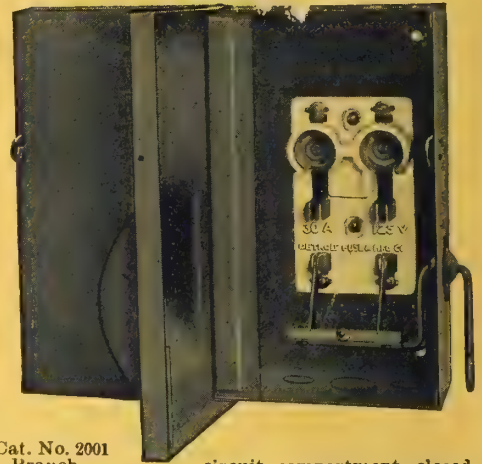
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Cat. No. 5211-E

Cover closed and locked, switch in "locked off" position.

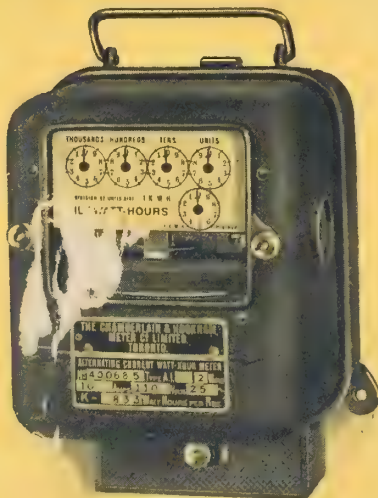


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Branch circuit compartment closed, switch compartment open, showing switch in "locked off" position. When switch is in above position if cover of switch compartment is closed and locked or sealed it is impossible to throw the switch on.

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